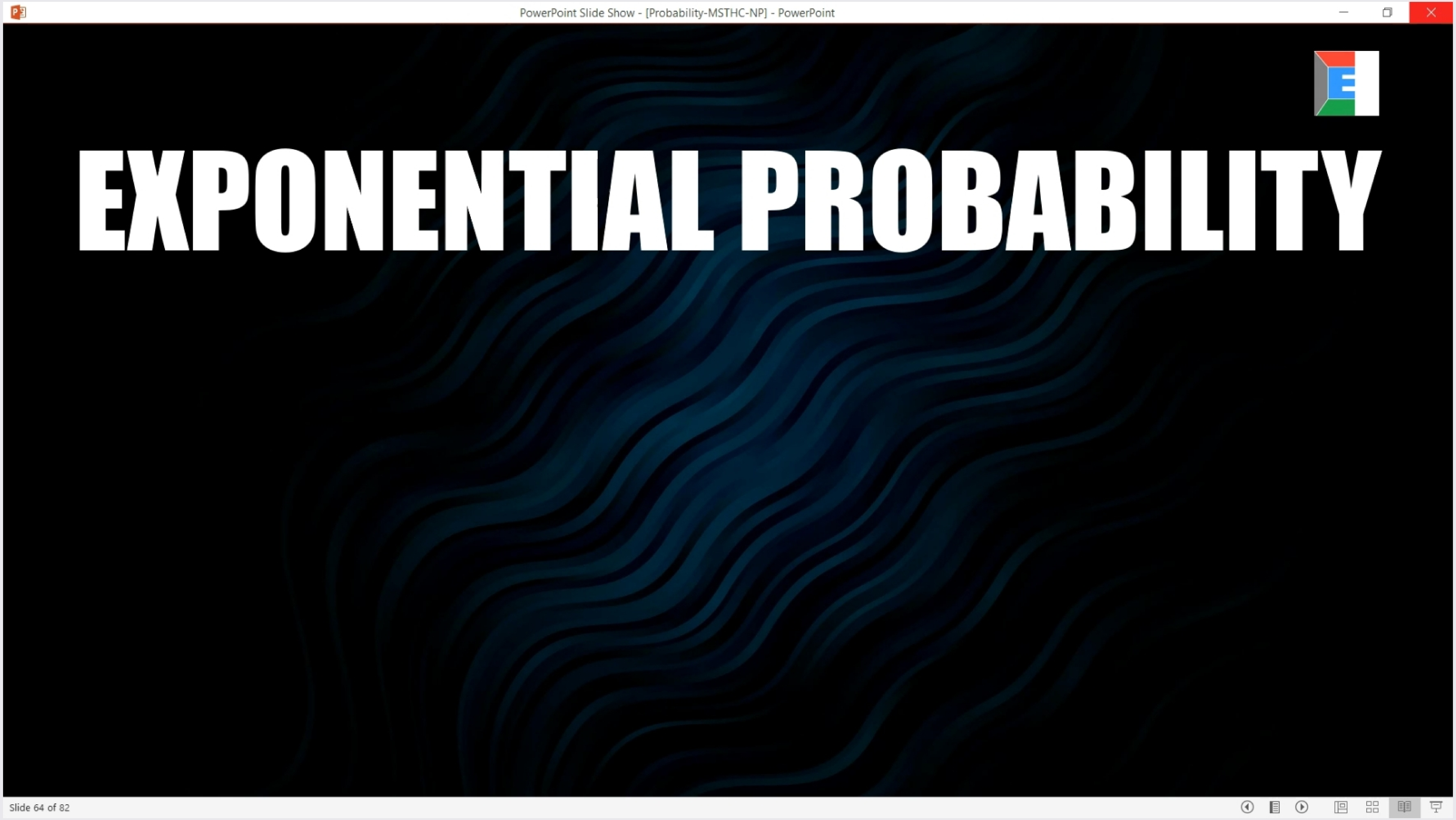
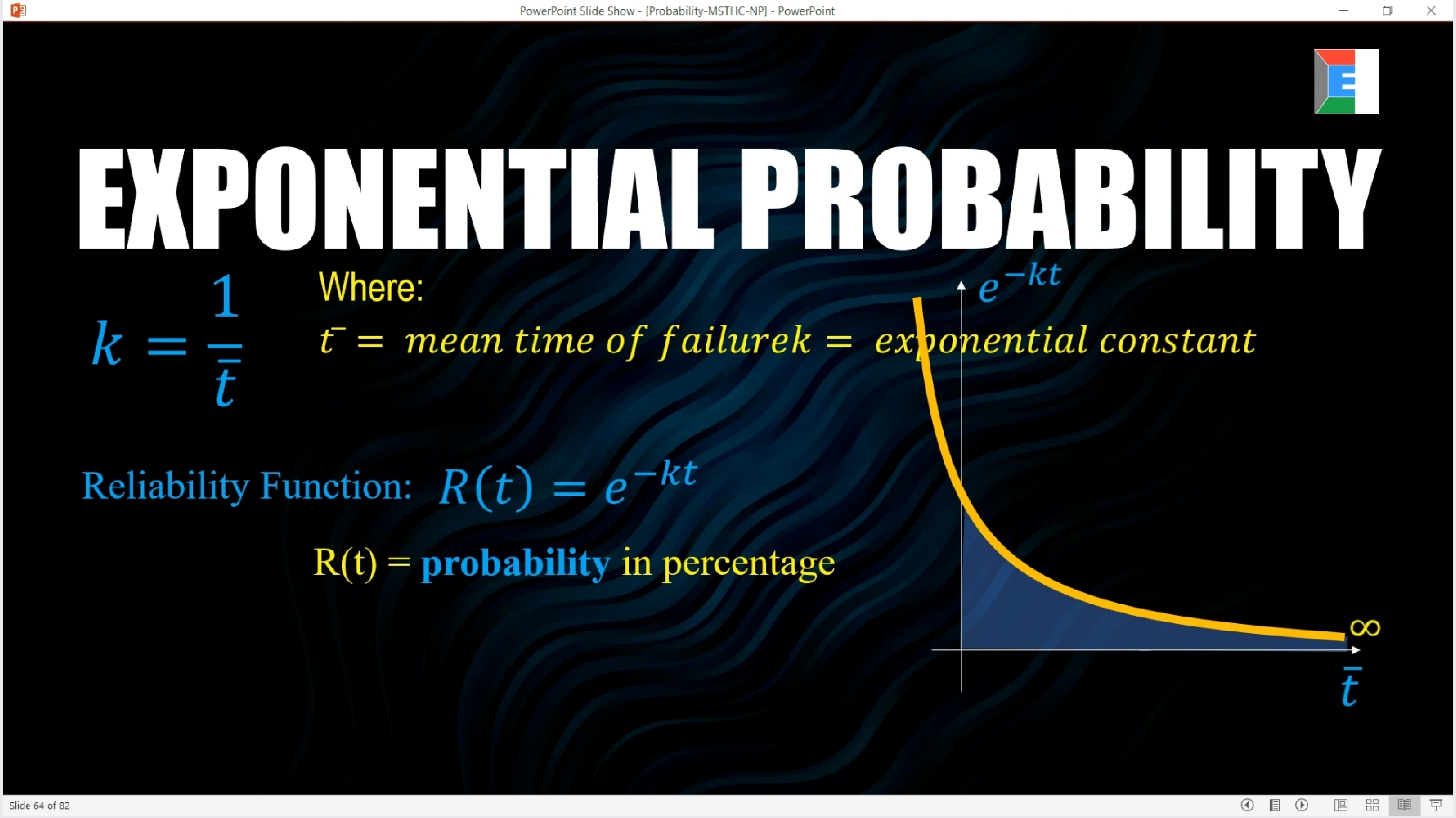

PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 64 of 82

EXPONENTIAL PROBABILITY


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
e^{-kt}
∞
$\bar{t}$
Slide 64 of 82

EXPONENTIAL PROBABILITY

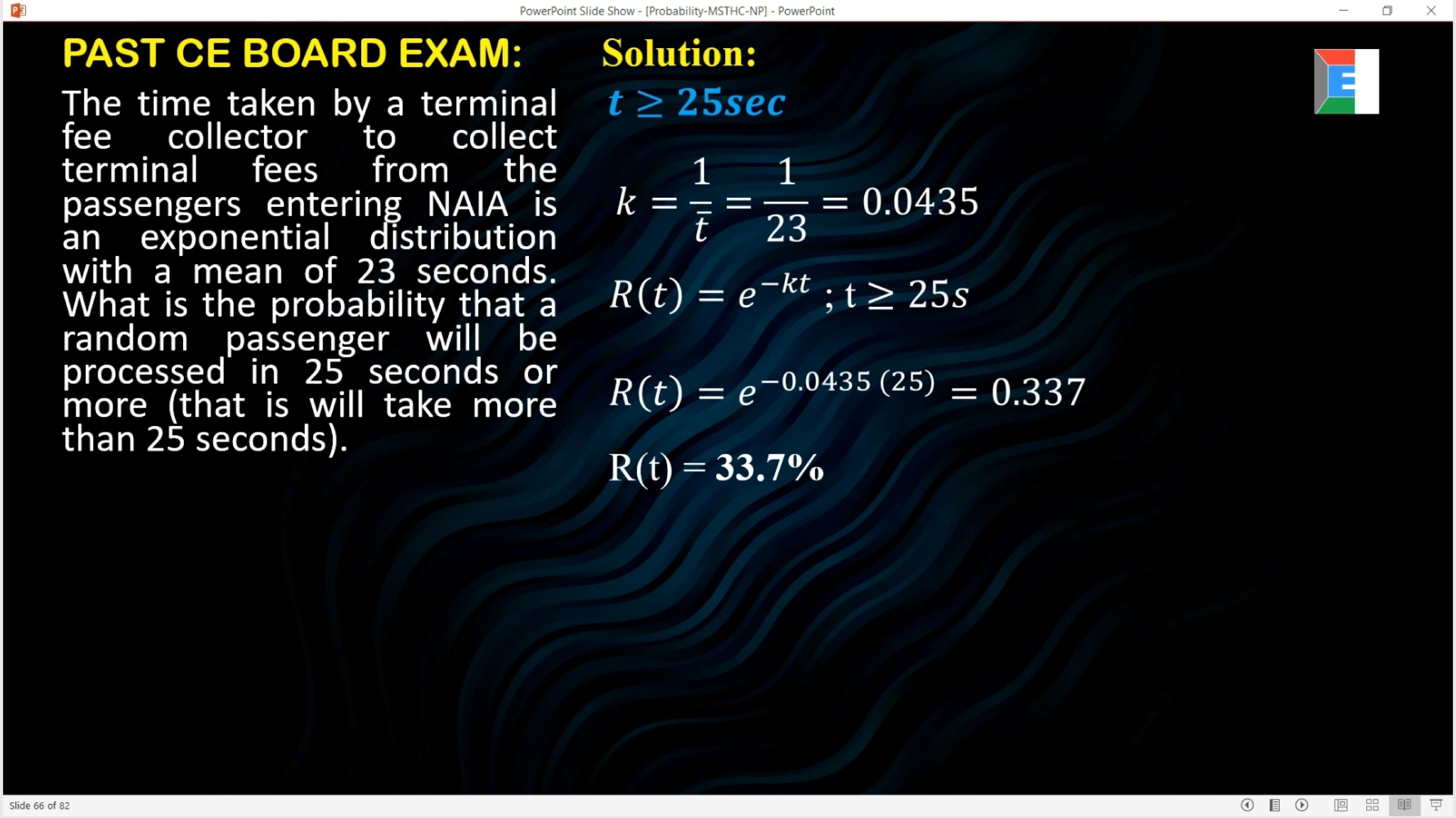
$$k = \frac{1}{\bar{t}}$$

Where:

$\bar{t} = mean\ time\ of\ failurek = \ exponential\ constant$

Reliability Function: $R(t) = e^{-kt}$

R(t) = **probability** in percentage


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 66 of 82

PAST CE BOARD EXAM:

The time taken by a terminal fee collector to collect terminal fees from the passengers entering NAIA is an exponential distribution with a mean of 23 seconds. What is the probability that a random passenger will be processed in 25 seconds or more (that is will take more than 25 seconds).

Solution:

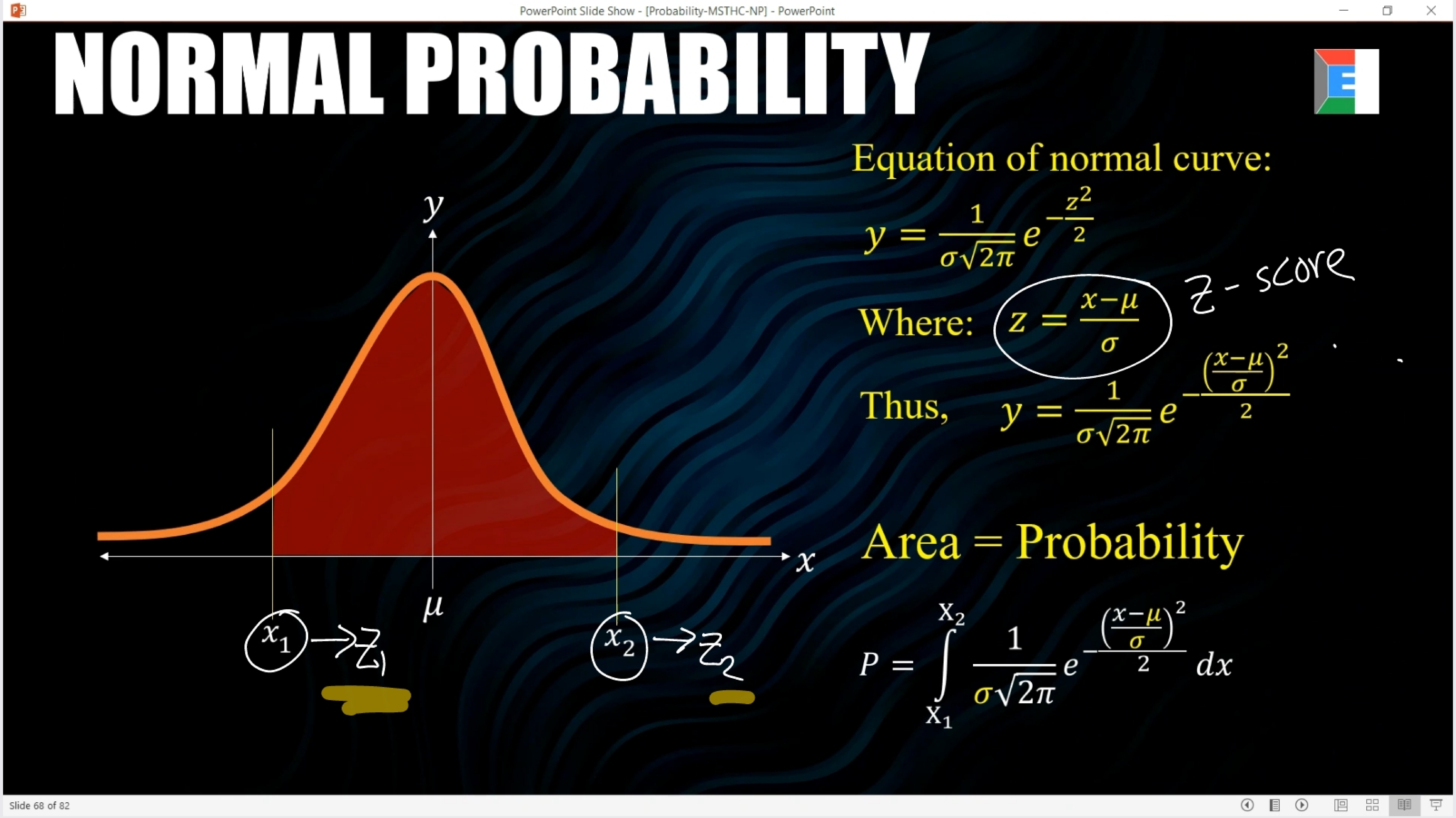
$$t \geq 25sec$$

$$k = \frac{1}{\bar{t}} = \frac{1}{23} = 0.0435$$

$$R(t) = e^{-kt} \; ; \mathrm{t} \geq 25s$$

$$R(t) = e^{-0.0435\,(25)} = 0.337$$

$$\mathrm{R(t)} = \mathbf{33.7\%}$$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
y
x
μ
$x_1 \rightarrow Z_1$
$x_2 \rightarrow Z_2$
Slide 68 of 82

NORMAL PROBABILITY

Equation of normal curve:

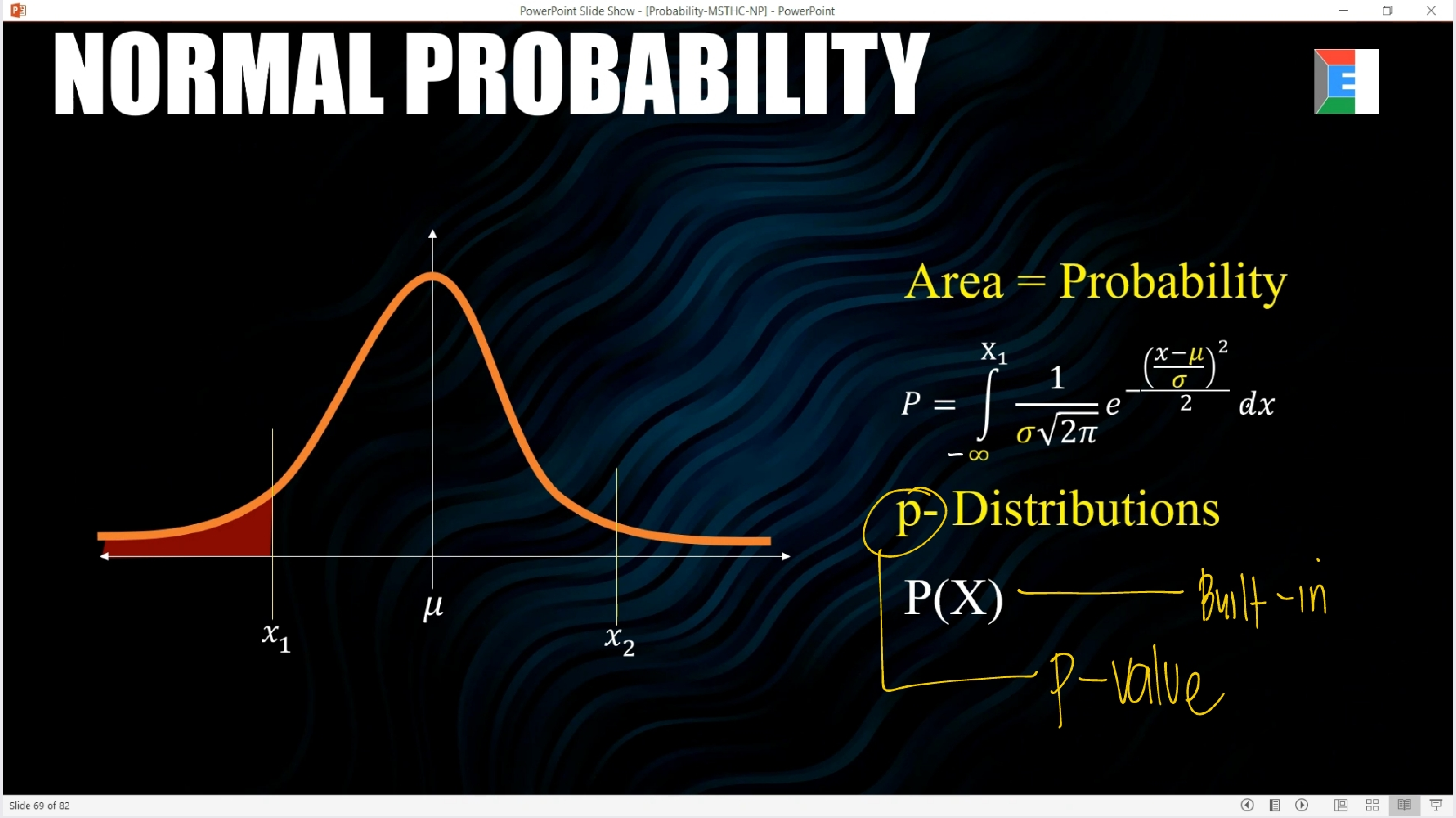
$$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{z^2}{2}}$$

Where: $z = \frac{x-\mu}{\sigma}$ Z - score

Thus, $y = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}}$

Area = Probability

$$P = \int_{X_1}^{X_2} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} dx$$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint

NORMAL PROBABILITY

x_1
μ
x_2

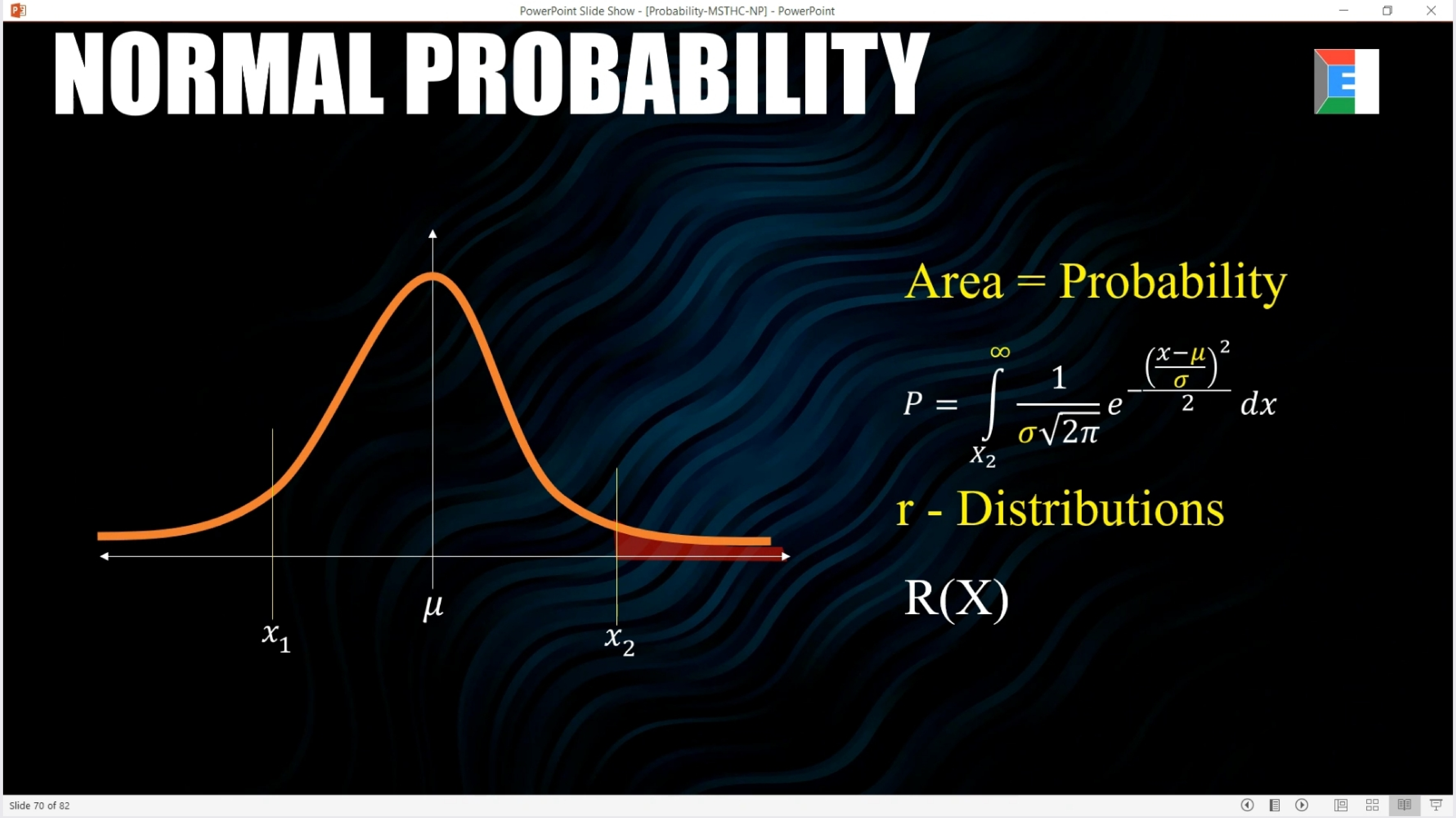
Area = Probability

$$P = \int_{-\infty}^{X_1} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} dx$$

p- Distributions

P(X) —— Built-in

P-value


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
x_1
μ
x_2
Slide 70 of 82

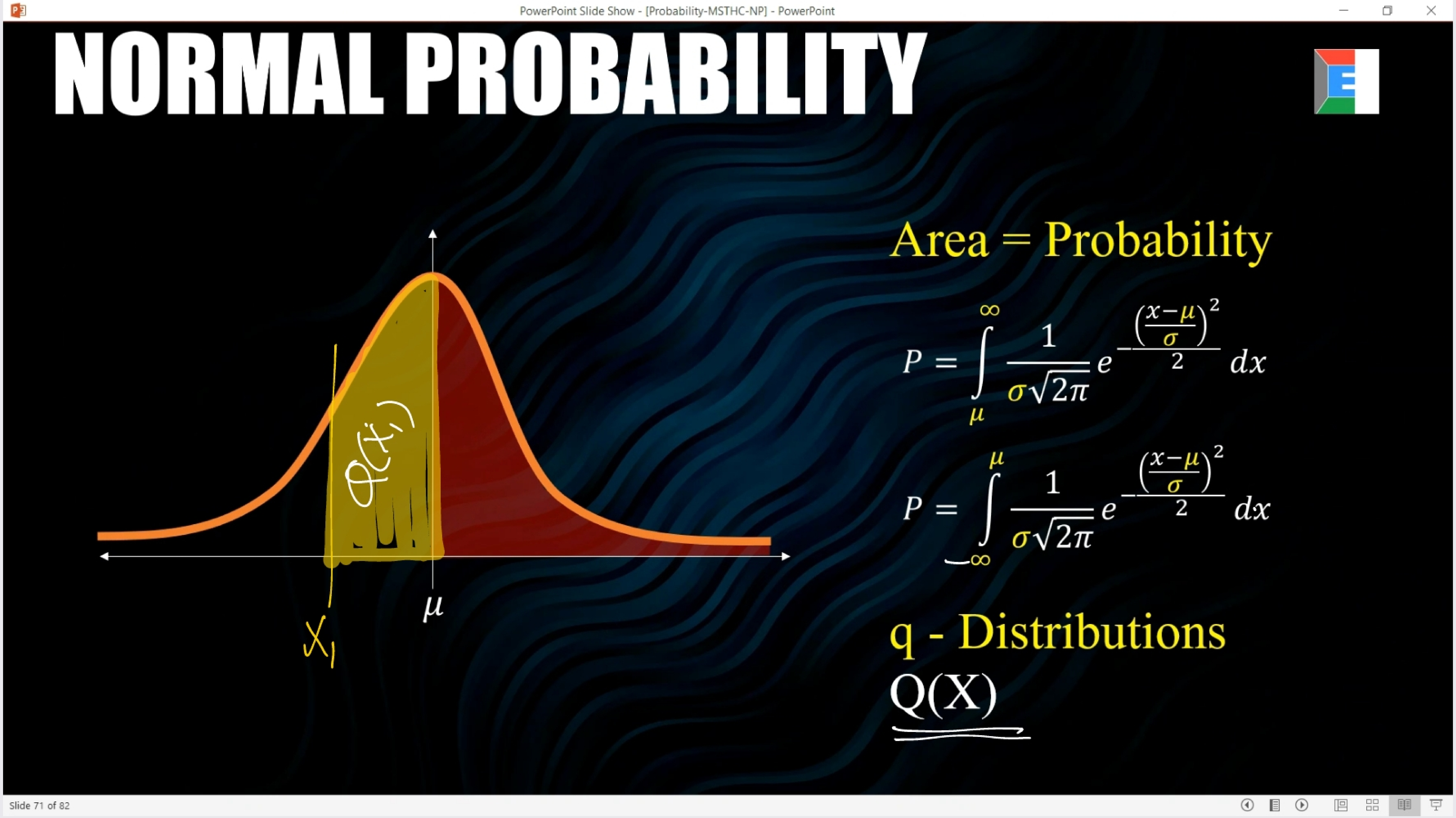
NORMAL PROBABILITY

Area = Probability

$$P = \int_{x_2}^{\infty} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} \, dx$$

r - Distributions

R(X)


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
μ
X_1
$Q(X_1)$
Slide 71 of 82

NORMAL PROBABILITY

Area = Probability

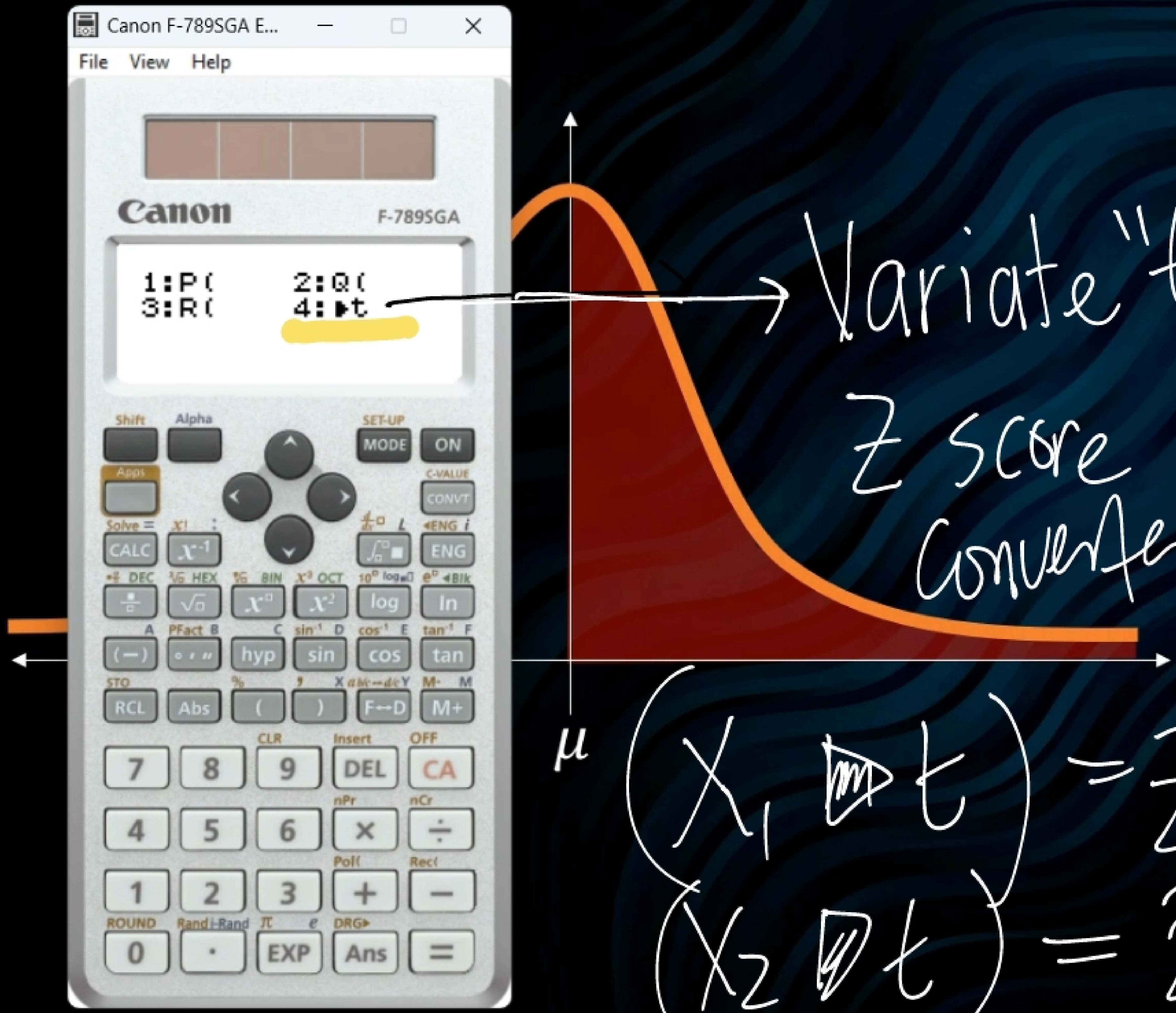
$$P = \int_{\mu}^{\infty} \frac{1}{\sigma\sqrt{2\pi}}\, e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}}\, dx$$

$$P = \int_{-\infty}^{\mu} \frac{1}{\sigma\sqrt{2\pi}}\, e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}}\, dx$$

q - Distributions

Q(X)

NORMAL PROBABILITY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1:P(2:Q(
3:R(4:▸t
μ

Variate "t"

Z score Converter

$(X_1 \blacktriangleright t) = Z_1$

$(X_2 \blacktriangleright t) = Z_2$

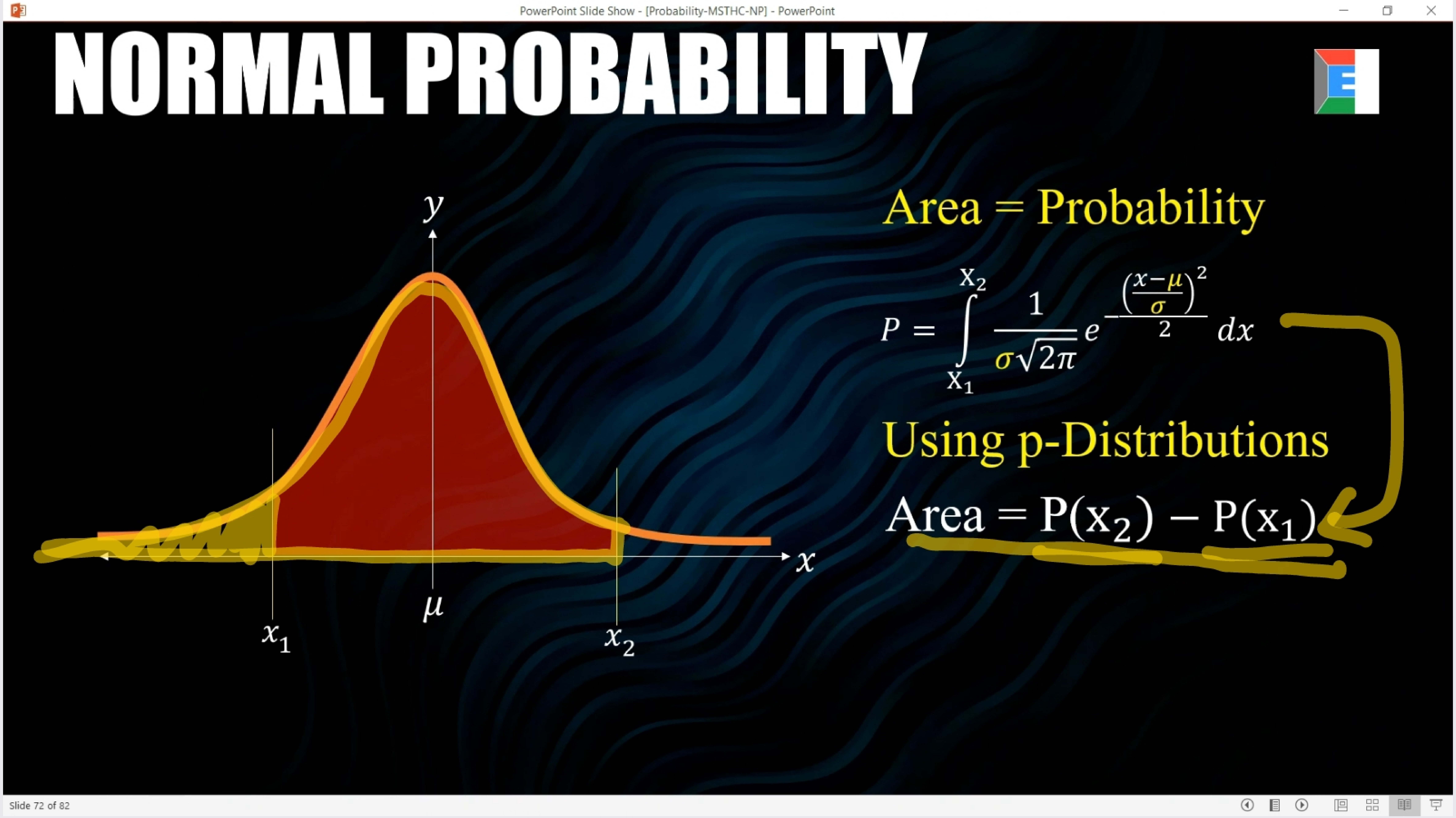
Area = Probability

$$P = \int_{\mu}^{\infty} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} dx$$

$$P = \int_{\infty}^{\mu} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} dx$$

q - Distributions

Q(X)


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
y
x
μ
x_1
x_2
Slide 72 of 82

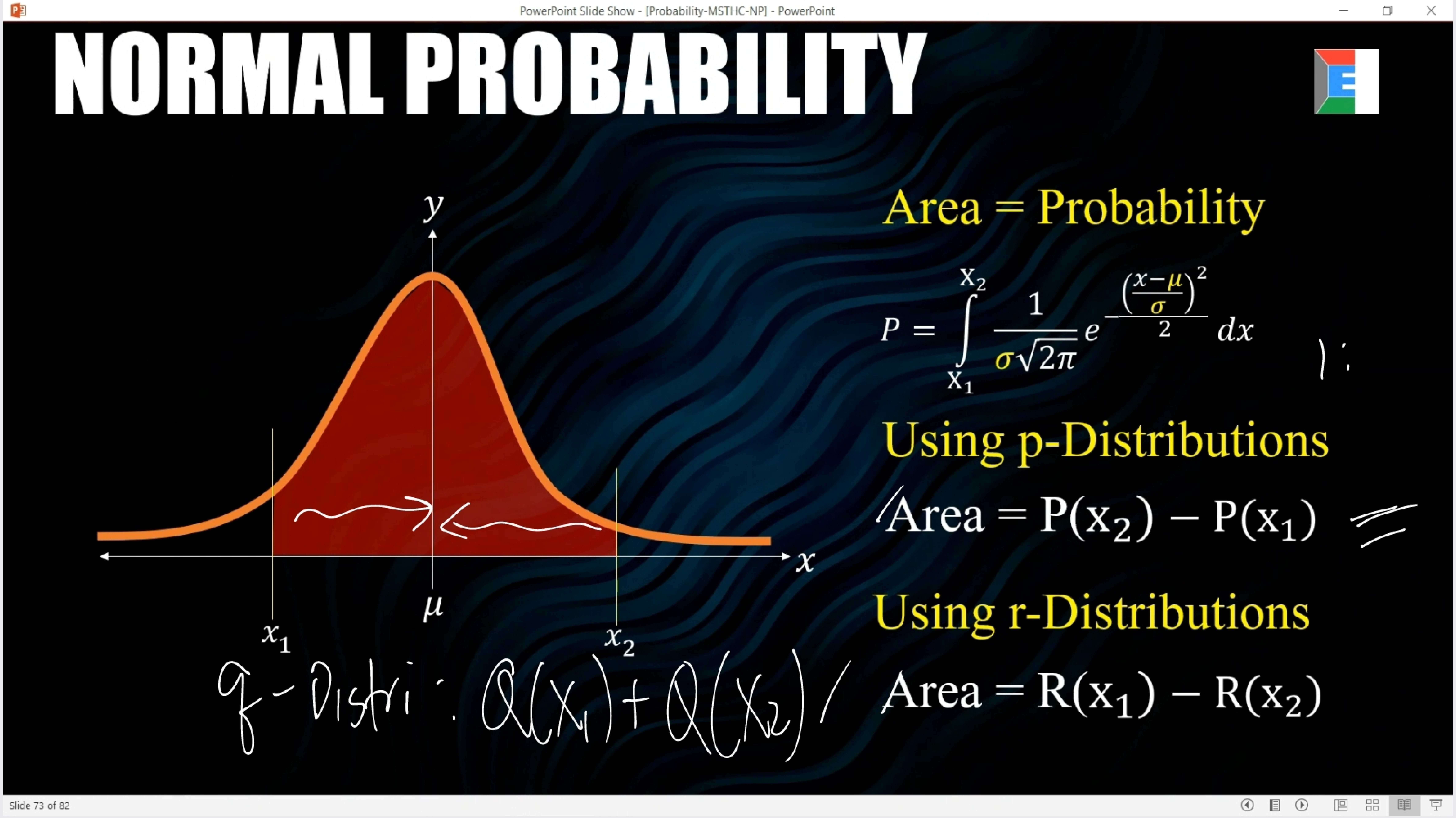
NORMAL PROBABILITY

Area = Probability

$$P = \int_{X_1}^{X_2} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} \, dx$$

Using p-Distributions

$$\text{Area} = P(x_2) - P(x_1)$$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
y
x
μ
x_1
x_2
Slide 73 of 82

NORMAL PROBABILITY

Area = Probability

$$P = \int_{x_1}^{x_2} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{\left(\frac{x-\mu}{\sigma}\right)^2}{2}} dx$$

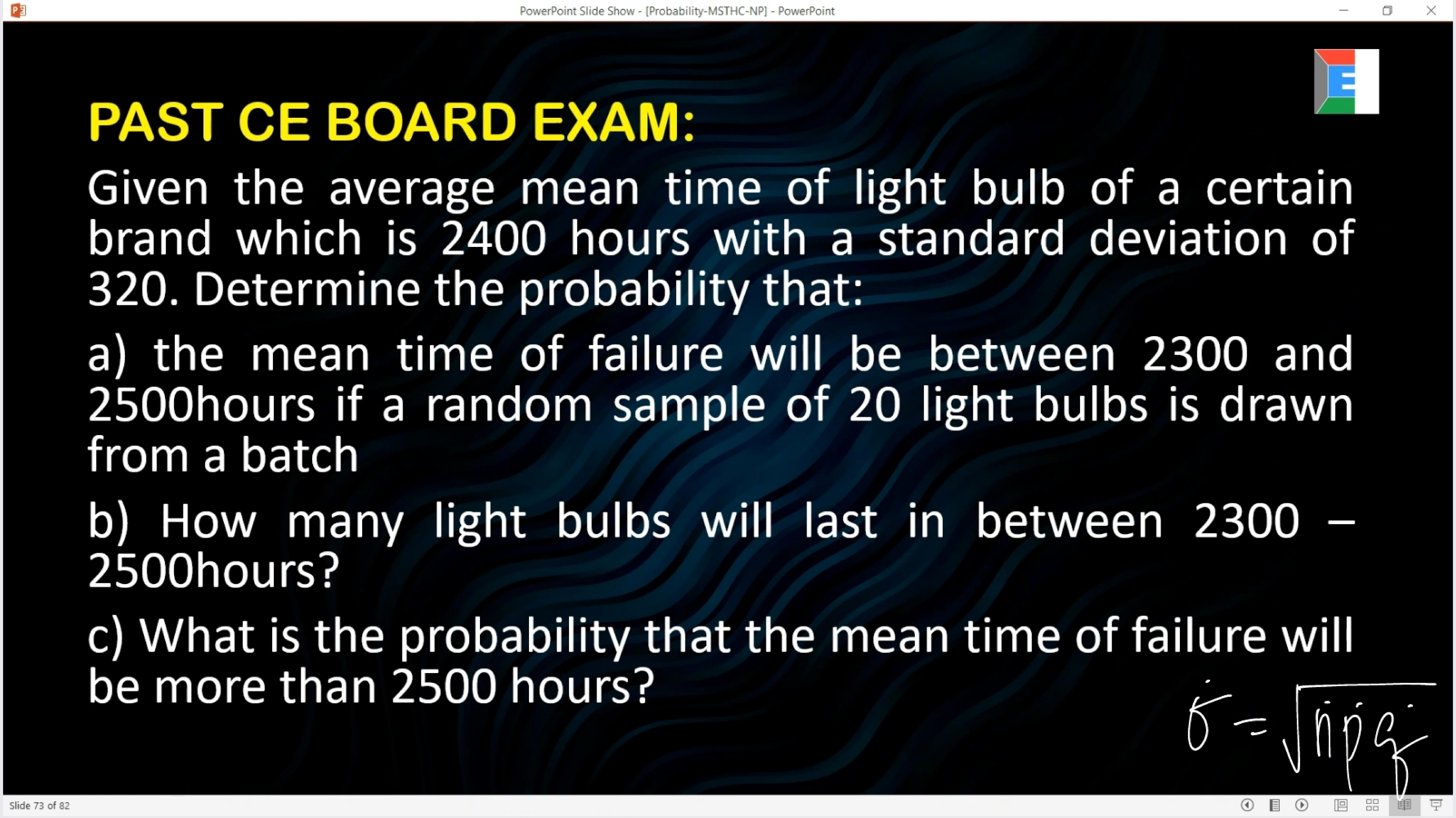
Using p-Distributions

$$\text{Area} = P(x_2) - P(x_1)$$

Using r-Distributions

$$\text{Area} = R(x_1) - R(x_2)$$

q-Distri : $Q(x_1) + Q(x_2)$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 73 of 82

PAST CE BOARD EXAM:

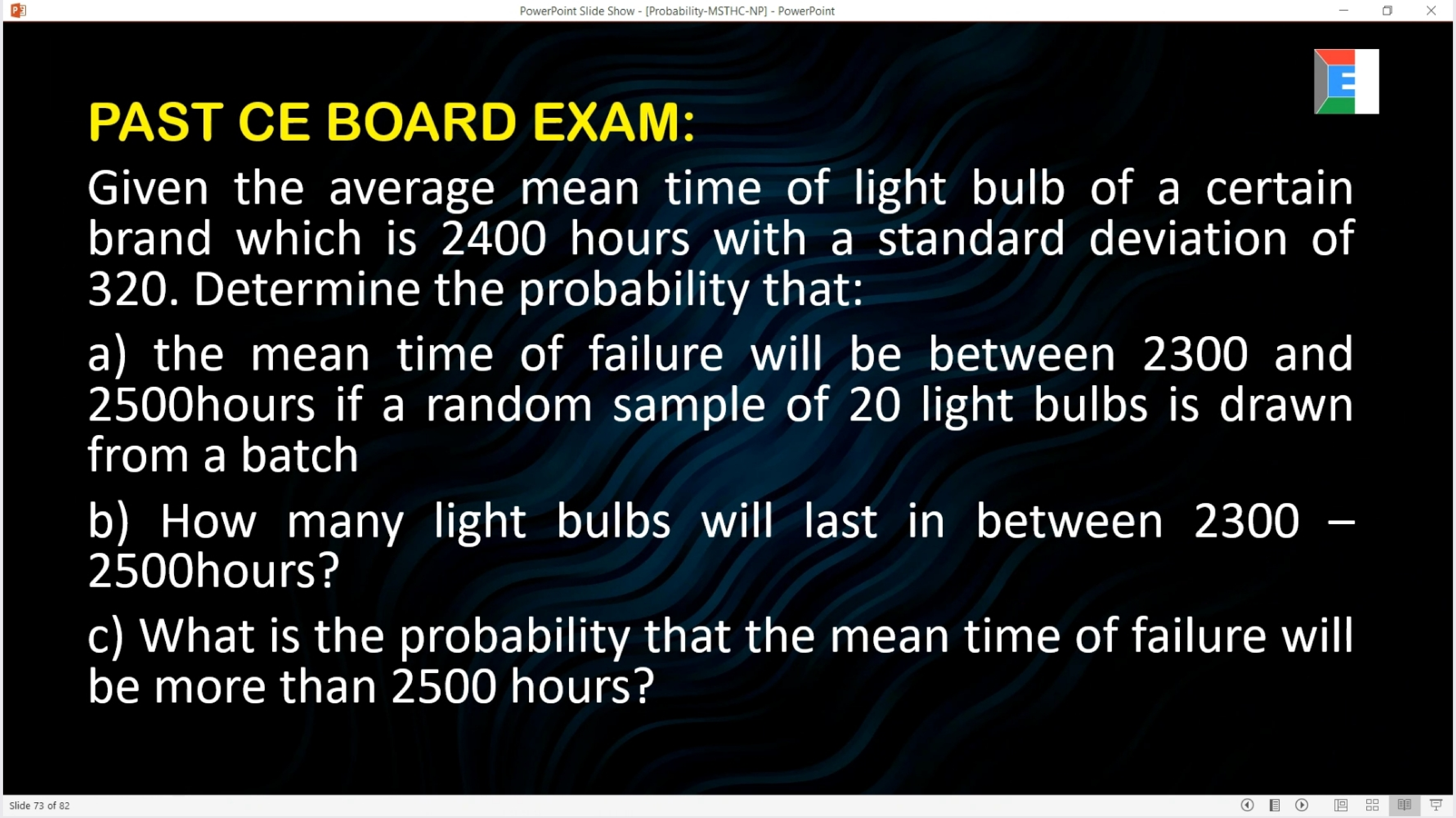
Given the average mean time of light bulb of a certain brand which is 2400 hours with a standard deviation of 320. Determine the probability that:

a) the mean time of failure will be between 2300 and 2500hours if a random sample of 20 light bulbs is drawn from a batch

b) How many light bulbs will last in between 2300 – 2500hours?

c) What is the probability that the mean time of failure will be more than 2500 hours?

$\sigma = \sqrt{npq}$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 73 of 82

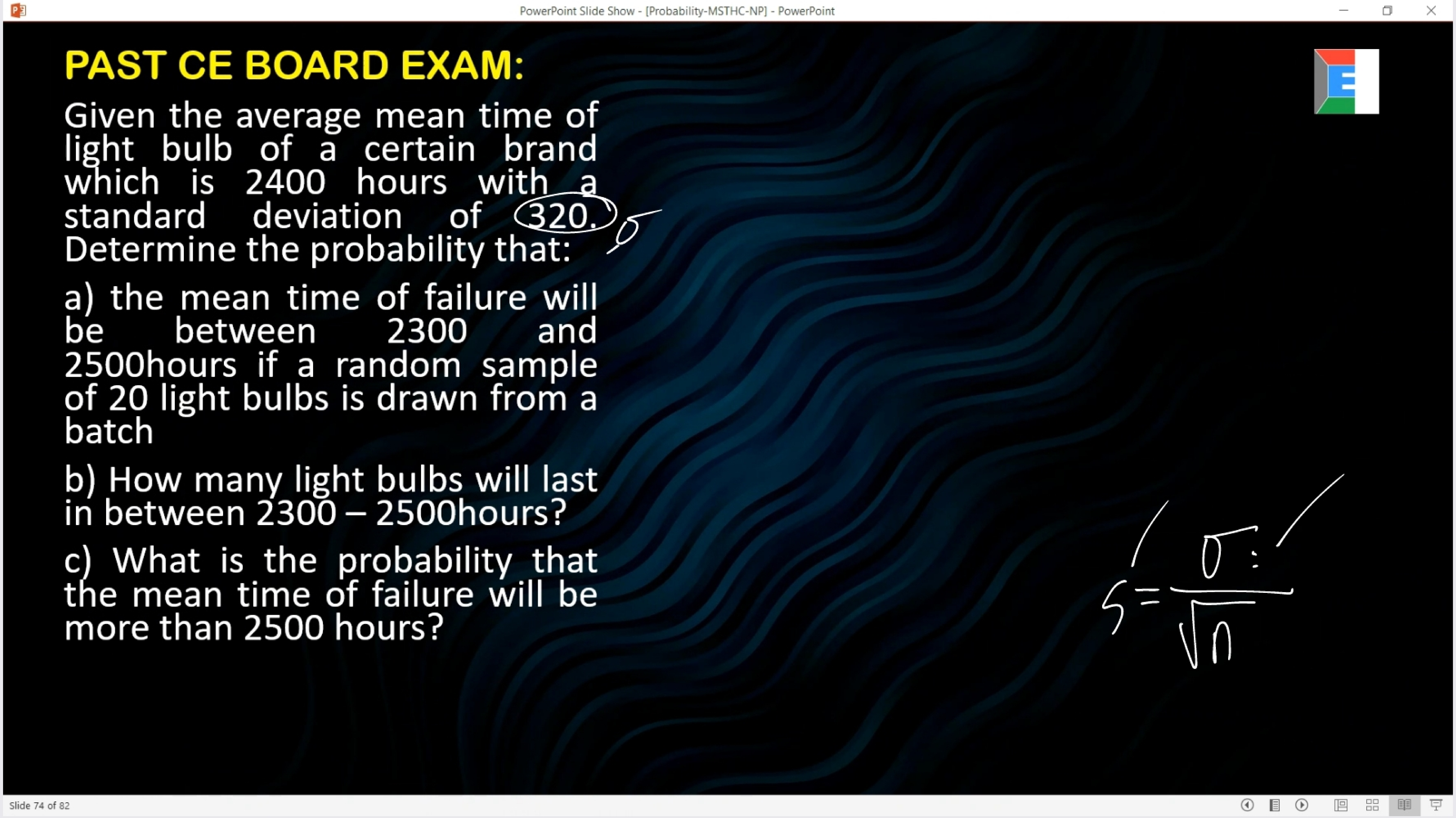
PAST CE BOARD EXAM:

Given the average mean time of light bulb of a certain brand which is 2400 hours with a standard deviation of 320. Determine the probability that:

a) the mean time of failure will be between 2300 and 2500hours if a random sample of 20 light bulbs is drawn from a batch

b) How many light bulbs will last in between 2300 – 2500hours?

c) What is the probability that the mean time of failure will be more than 2500 hours?


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint

PAST CE BOARD EXAM:

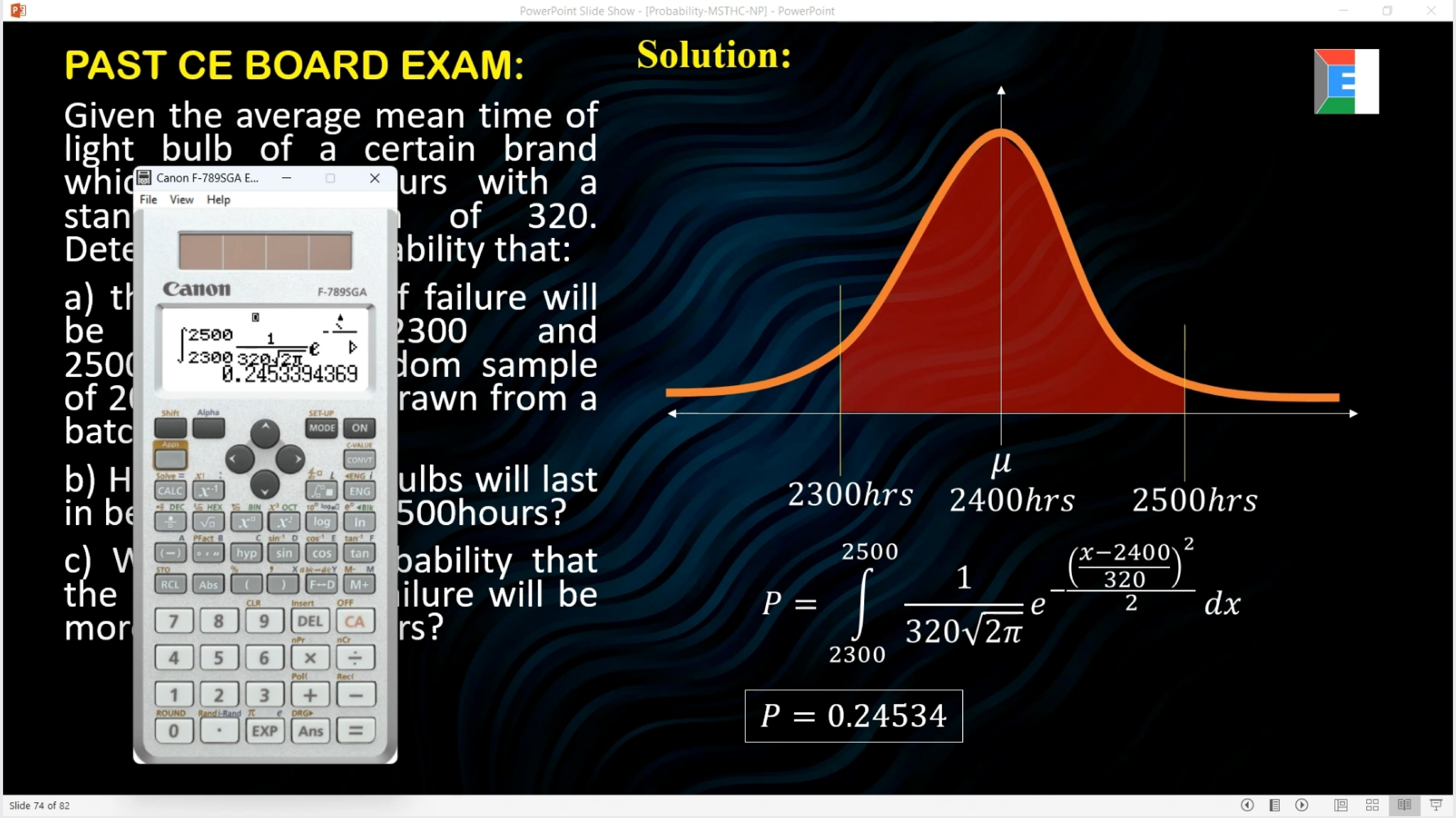
Given the average mean time of light bulb of a certain brand which is 2400 hours with a standard deviation of 320. σ
Determine the probability that:

a) the mean time of failure will be between 2300 and 2500hours if a random sample of 20 light bulbs is drawn from a batch

b) How many light bulbs will last in between 2300 – 2500hours?

c) What is the probability that the mean time of failure will be more than 2500 hours?

$$s = \frac{\sigma}{\sqrt{n}}$$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μ
2300hrs
2400hrs
2500hrs
Slide 74 of 82

PAST CE BOARD EXAM:

Given the average mean time of
light bulb of a certain brand
whic urs with a
stan of 320.
Dete ability that:

a) th f failure will
be 2300 and
250 dom sample
of 2 rawn from a
batc

b) H ulbs will last
in be 500hours?

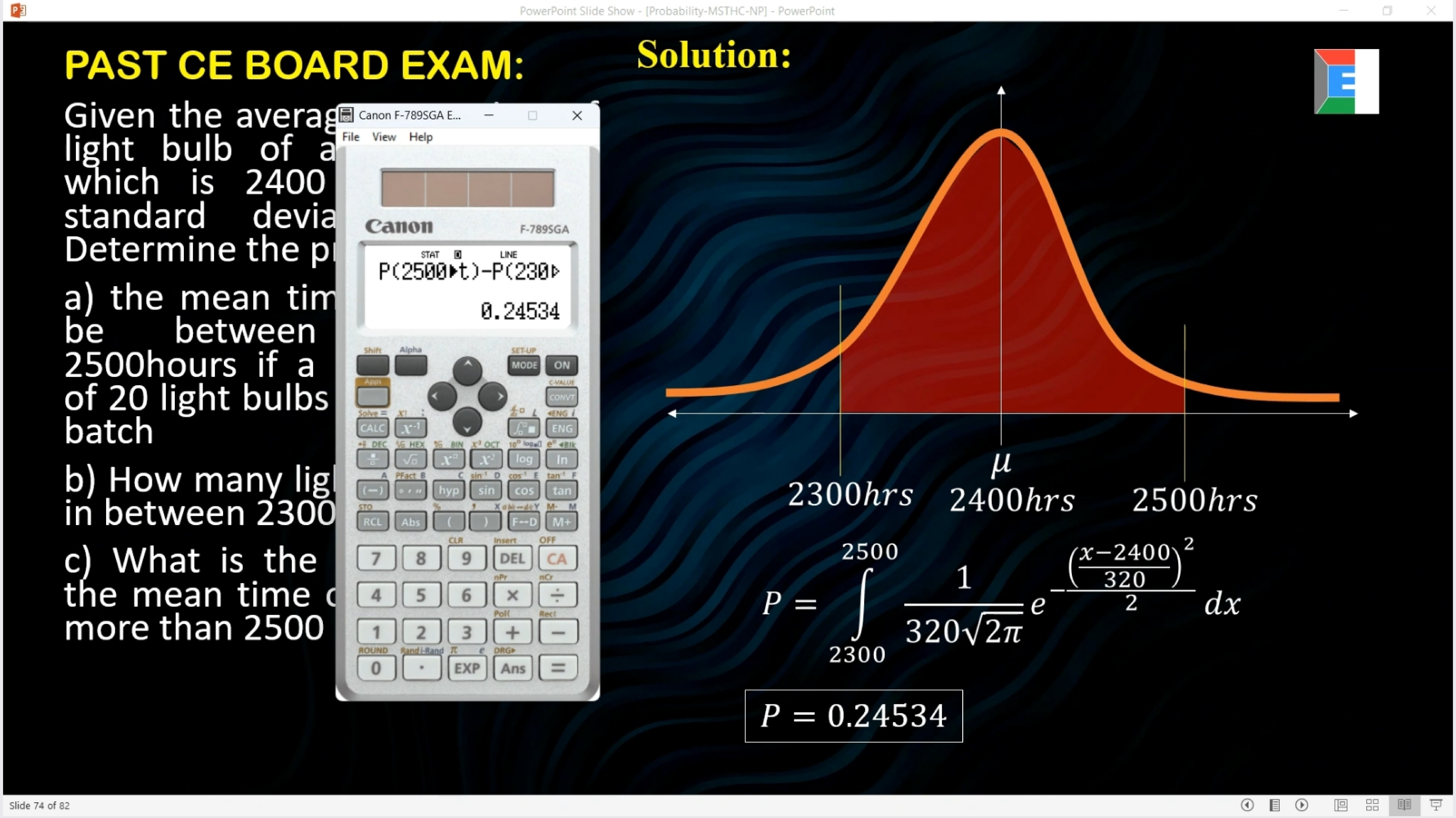
c) W ability that
the ilure will be
mor rs?

```
∫2300^2500 1/(320√2π) e
        0.2453394369
```

Solution:

$$P = \int_{2300}^{2500} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

$$\boxed{P = 0.24534}$$



PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint

PAST CE BOARD EXAM:

Given the averag
light bulb of a
which is 2400
standard devia
Determine the pr

a) the mean tim
be between
2500hours if a
of 20 light bulbs
batch

b) How many ligl
in between 2300

c) What is the
the mean time c
more than 2500

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```
P(2500▸t)-P(230▸
0.24534
```

Solution:

μ
2300hrs
2400hrs
2500hrs

$$P = \int_{2300}^{2500} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

$$\boxed{P = 0.24534}$$

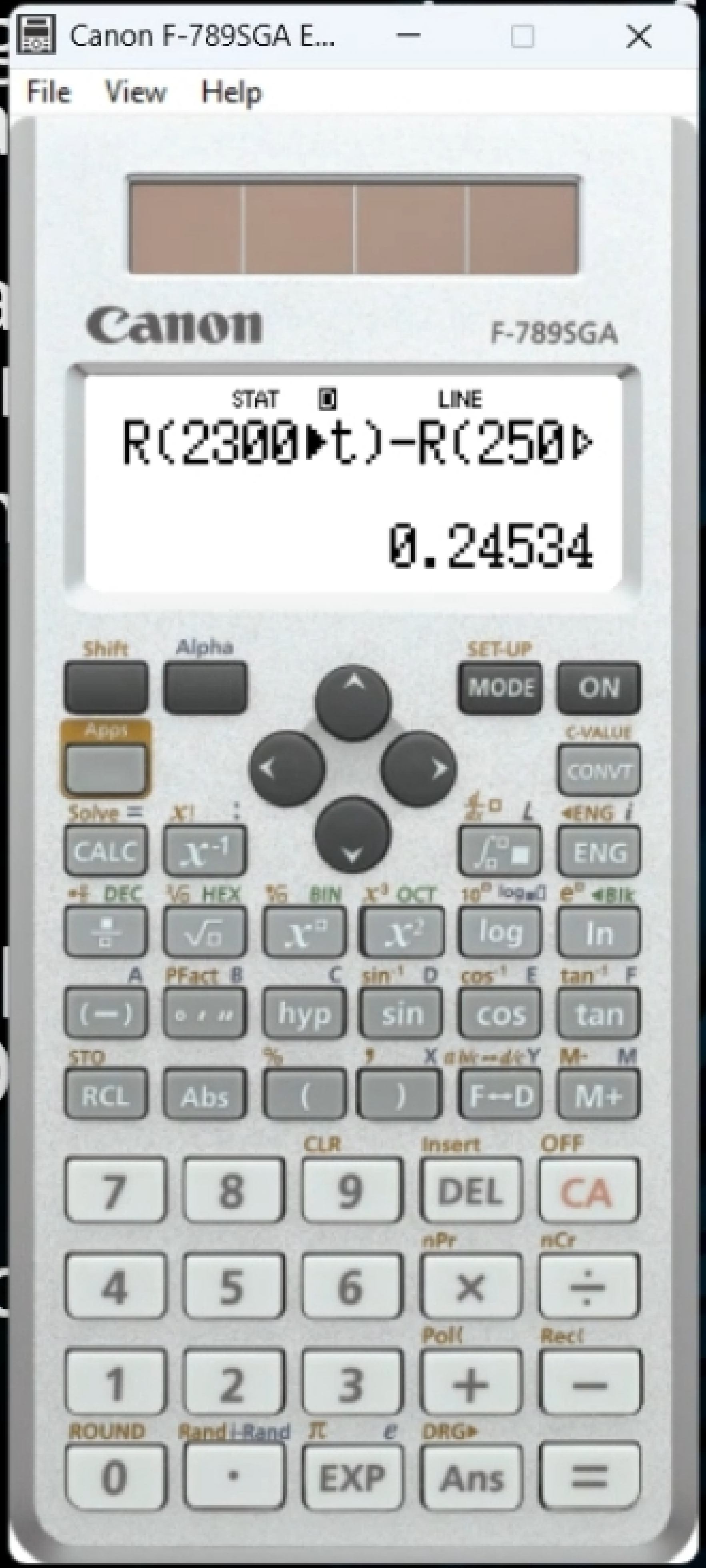
PAST CE BOARD EXAM:

Given the averag
light bulb of a
which is 2400
standard devia
Determine the pr

a) the mean tim
be between
2500hours if a
of 20 light bulbs
batch

b) How many ligl
in between 2300

c) What is the
the mean time c
more than 2500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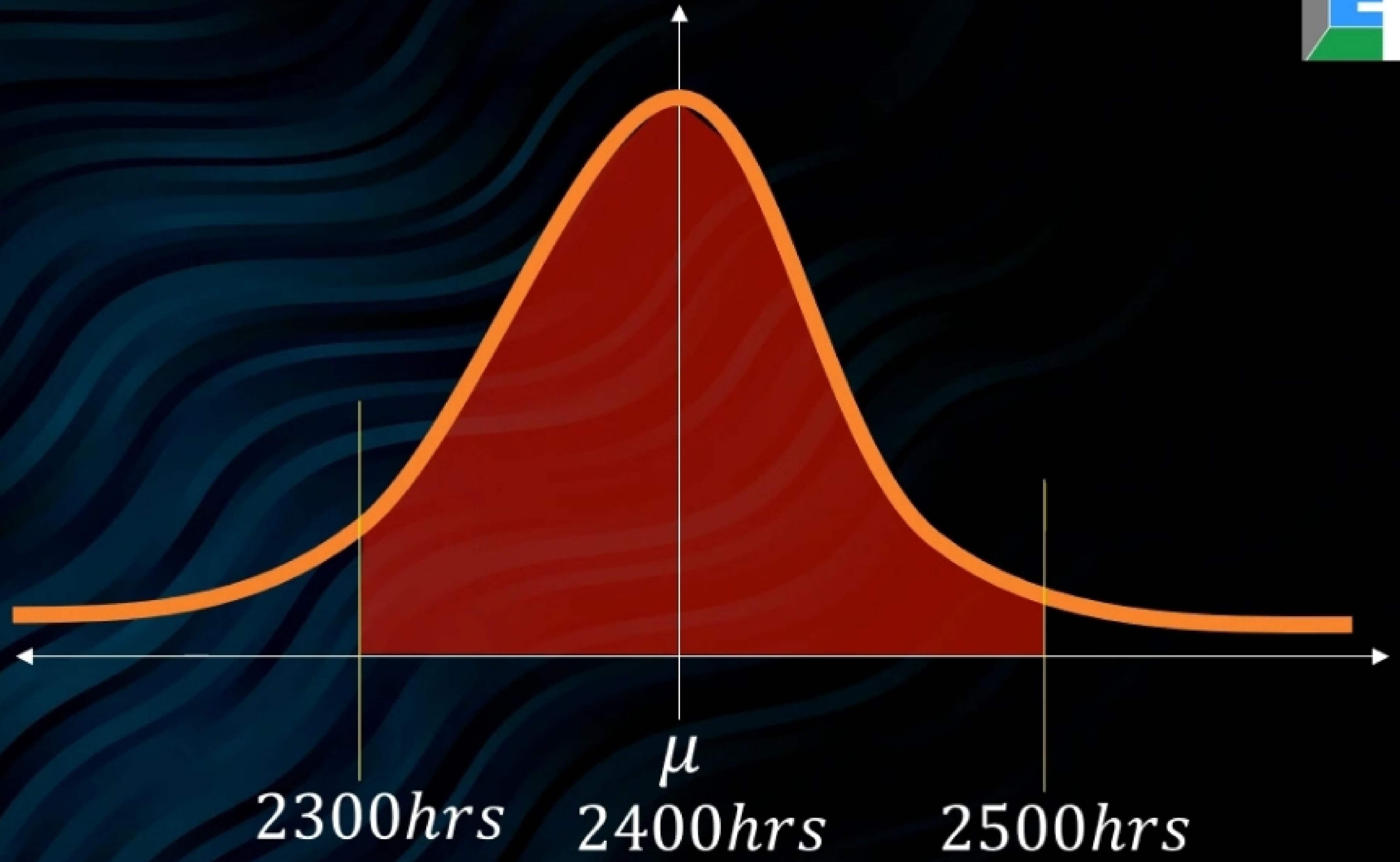
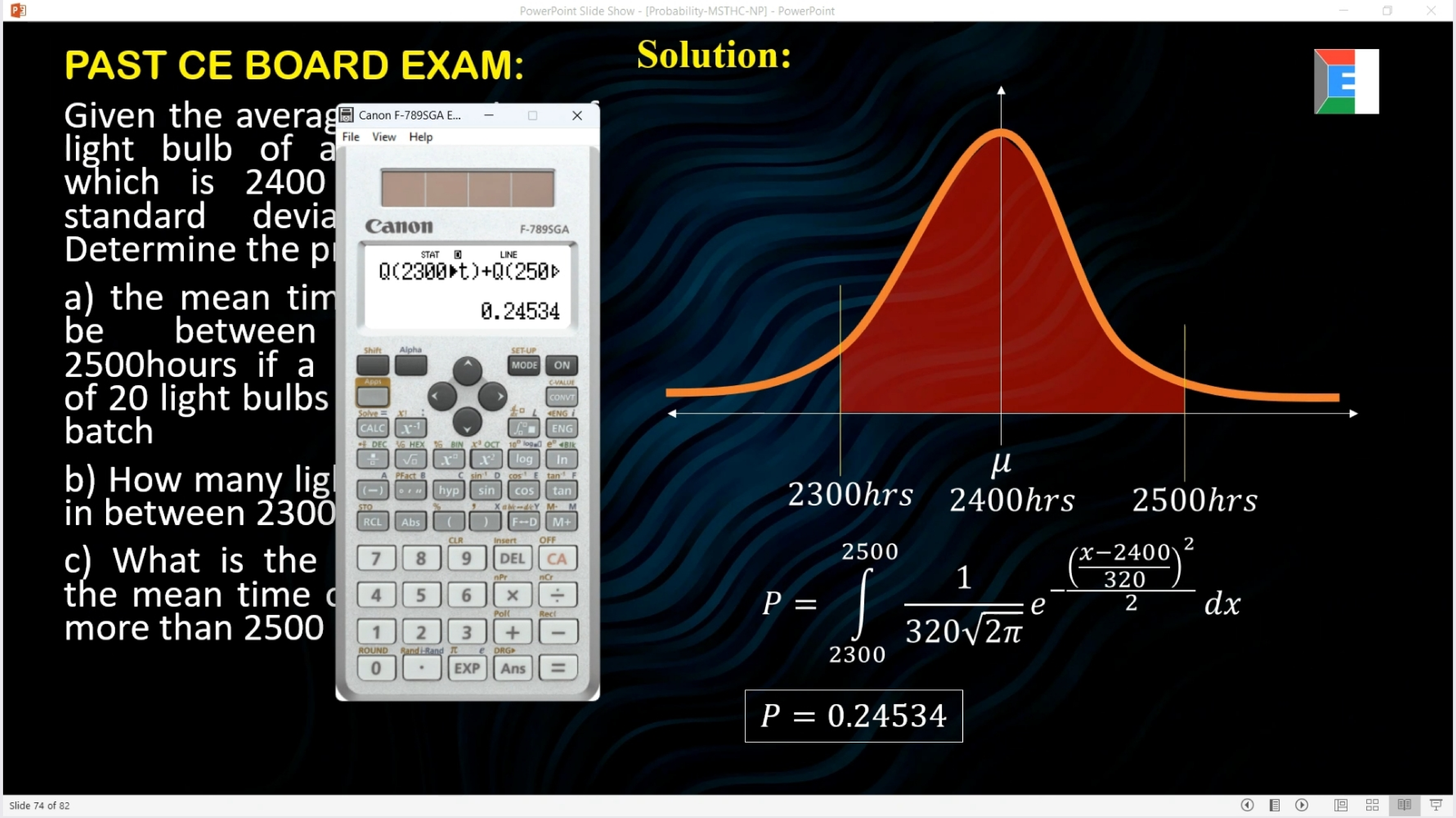
```
R(2300▸t)-R(250▸
                0.24534
```

Solution:


μ
2300hrs
2400hrs
2500hrs

$$P = \int_{2300}^{2500} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

$$\boxed{P = 0.24534}$$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Slide 74 of 82

PAST CE BOARD EXAM:

Given the averag
light bulb of a
which is 2400
standard devia
Determine the pr

a) the mean tim
be between
2500hours if a
of 20 light bulbs
batch

b) How many ligh
in between 2300

c) What is the
the mean time o
more than 2500

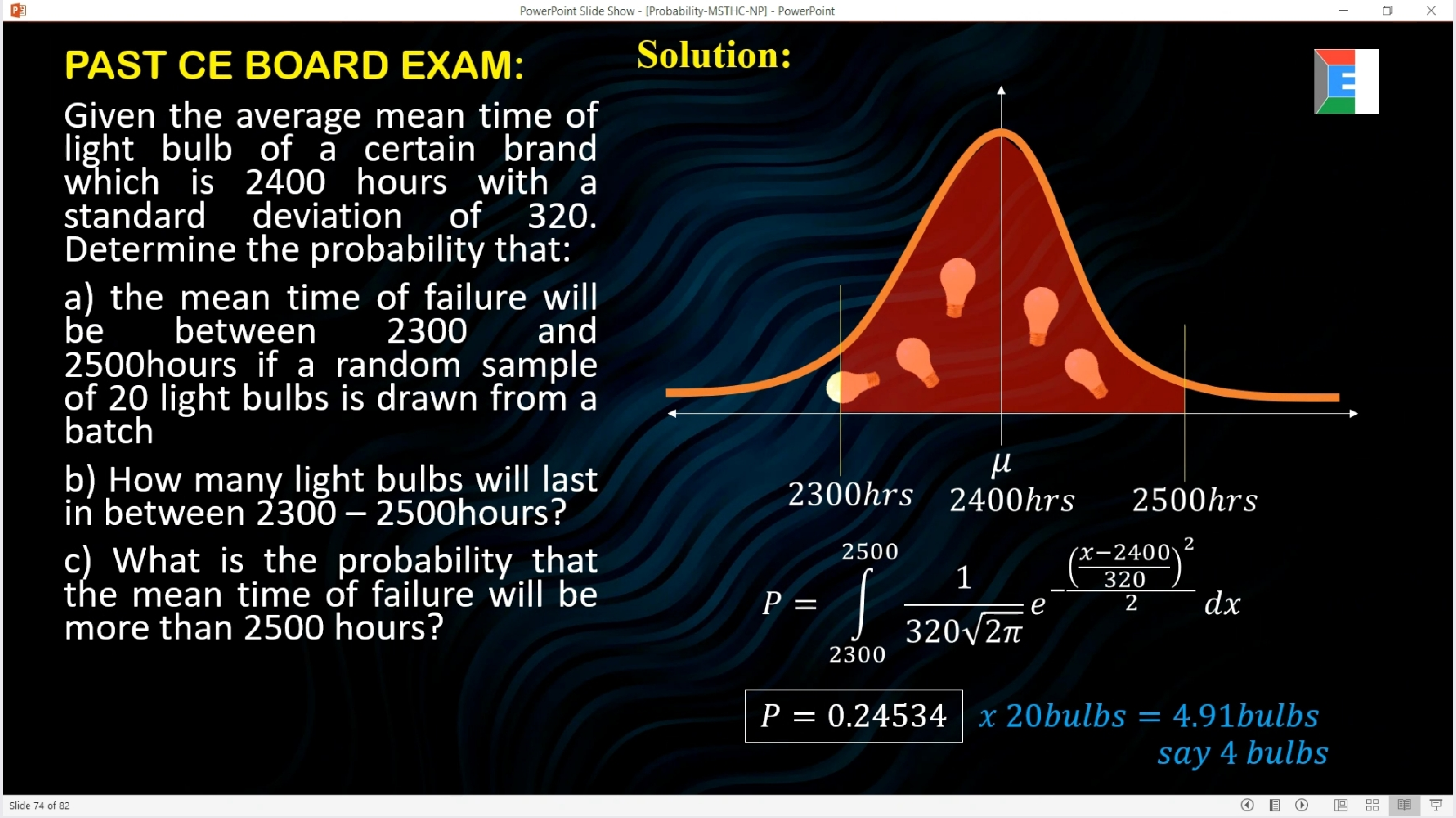
```
Q(2300▶t)+Q(250▶
          0.24534
```

Solution:

μ
2300hrs
2400hrs
2500hrs

$$P = \int_{2300}^{2500} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

$$\boxed{P = 0.24534}$$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
μ
2300hrs
2400hrs
2500hrs
Slide 74 of 82

PAST CE BOARD EXAM:

Given the average mean time of light bulb of a certain brand which is 2400 hours with a standard deviation of 320. Determine the probability that:

a) the mean time of failure will be between 2300 and 2500hours if a random sample of 20 light bulbs is drawn from a batch

b) How many light bulbs will last in between 2300 – 2500hours?

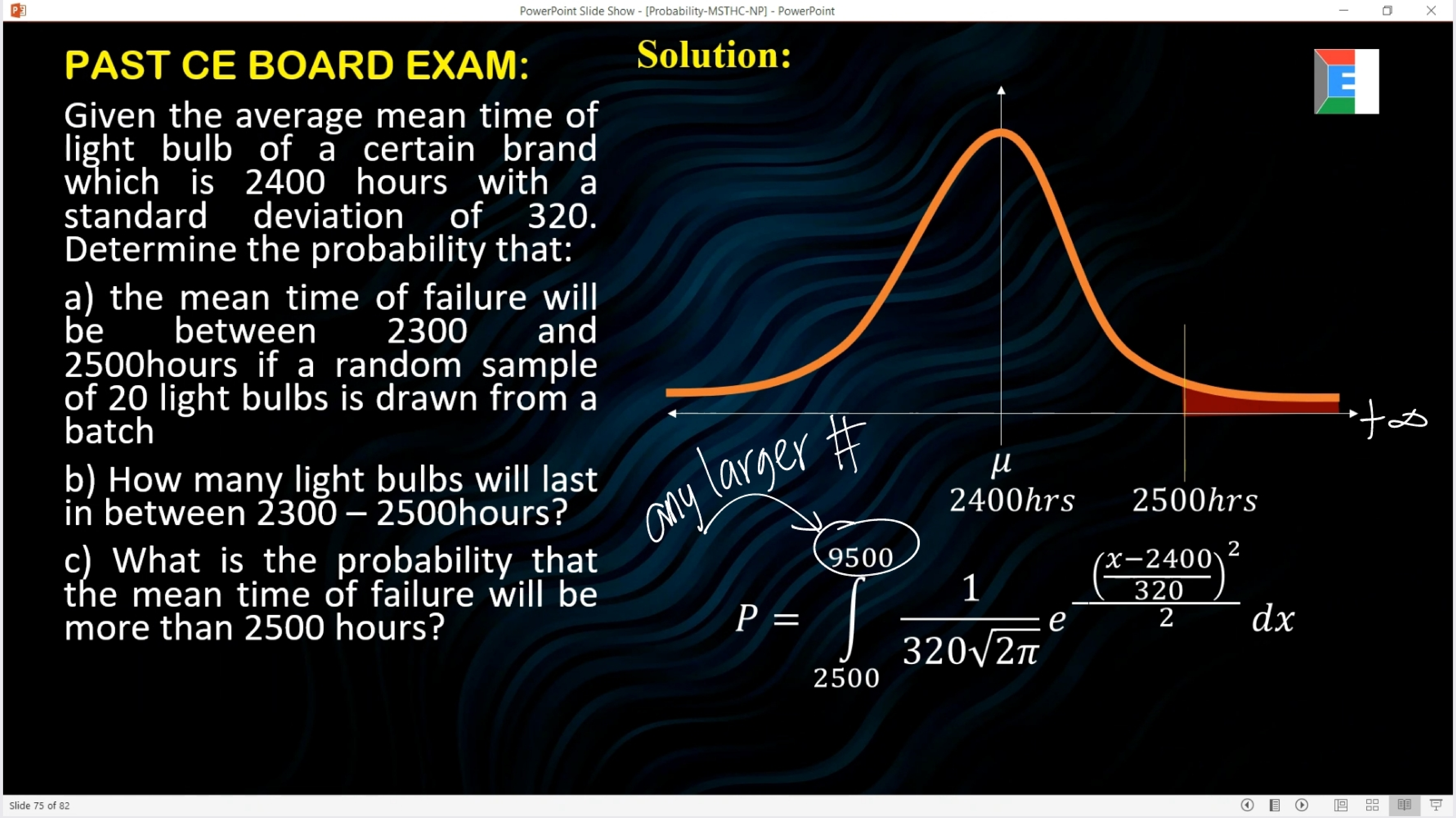
c) What is the probability that the mean time of failure will be more than 2500 hours?

Solution:

$$P = \int_{2300}^{2500} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

$$\boxed{P = 0.24534} \; x\ 20 bulbs = 4.91 bulbs$$

$$say\ 4\ bulbs$$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
+∞
μ
2400hrs
2500hrs
any larger #
Slide 75 of 82

PAST CE BOARD EXAM:

Given the average mean time of light bulb of a certain brand which is 2400 hours with a standard deviation of 320. Determine the probability that:

a) the mean time of failure will be between 2300 and 2500hours if a random sample of 20 light bulbs is drawn from a batch

b) How many light bulbs will last in between 2300 – 2500hours?

c) What is the probability that the mean time of failure will be more than 2500 hours?

Solution:

$$P = \int_{2500}^{\boxed{9500}} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

PAST CE BOARD EXAM:

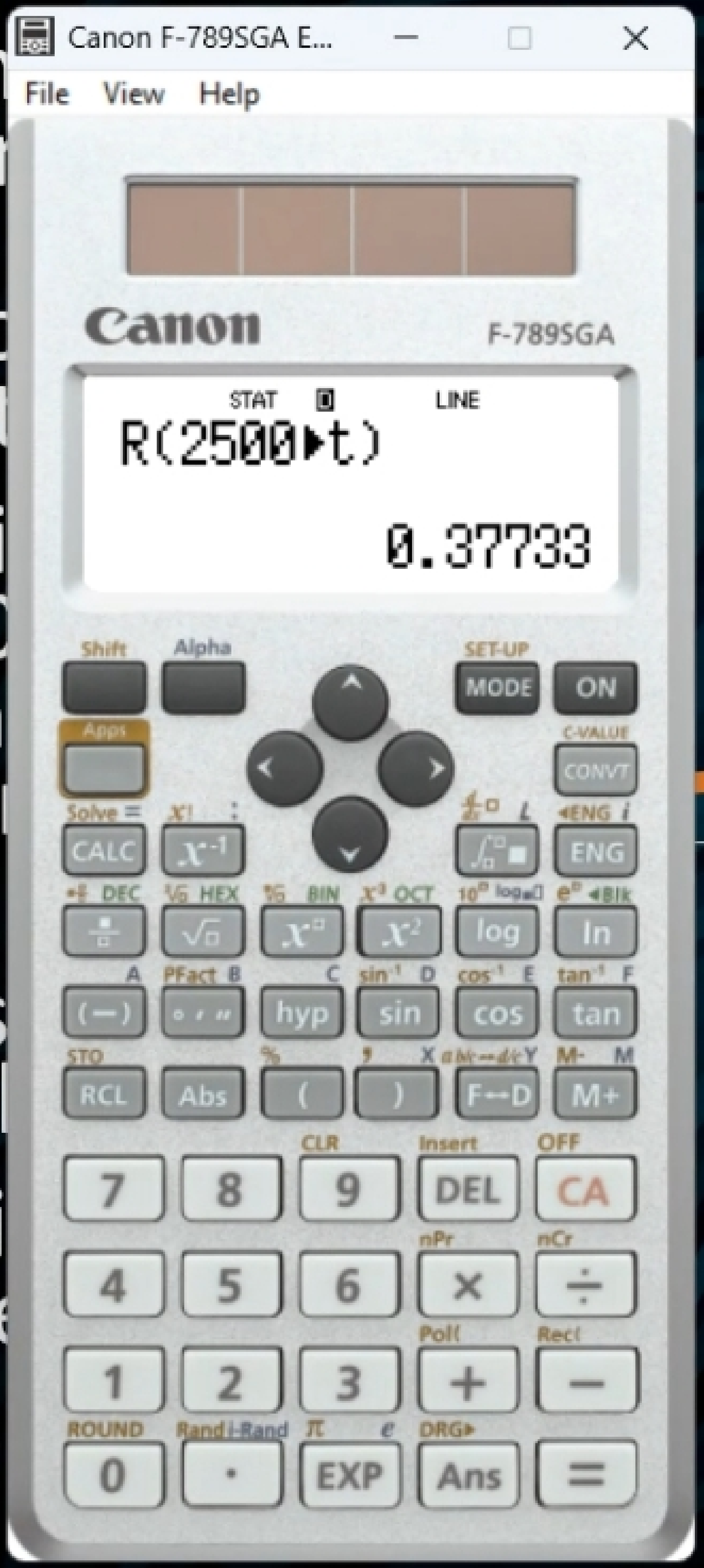
Solution:

Given the average mean light bulb of a certai which is 2400 hours standard deviation c Determine the probabilit

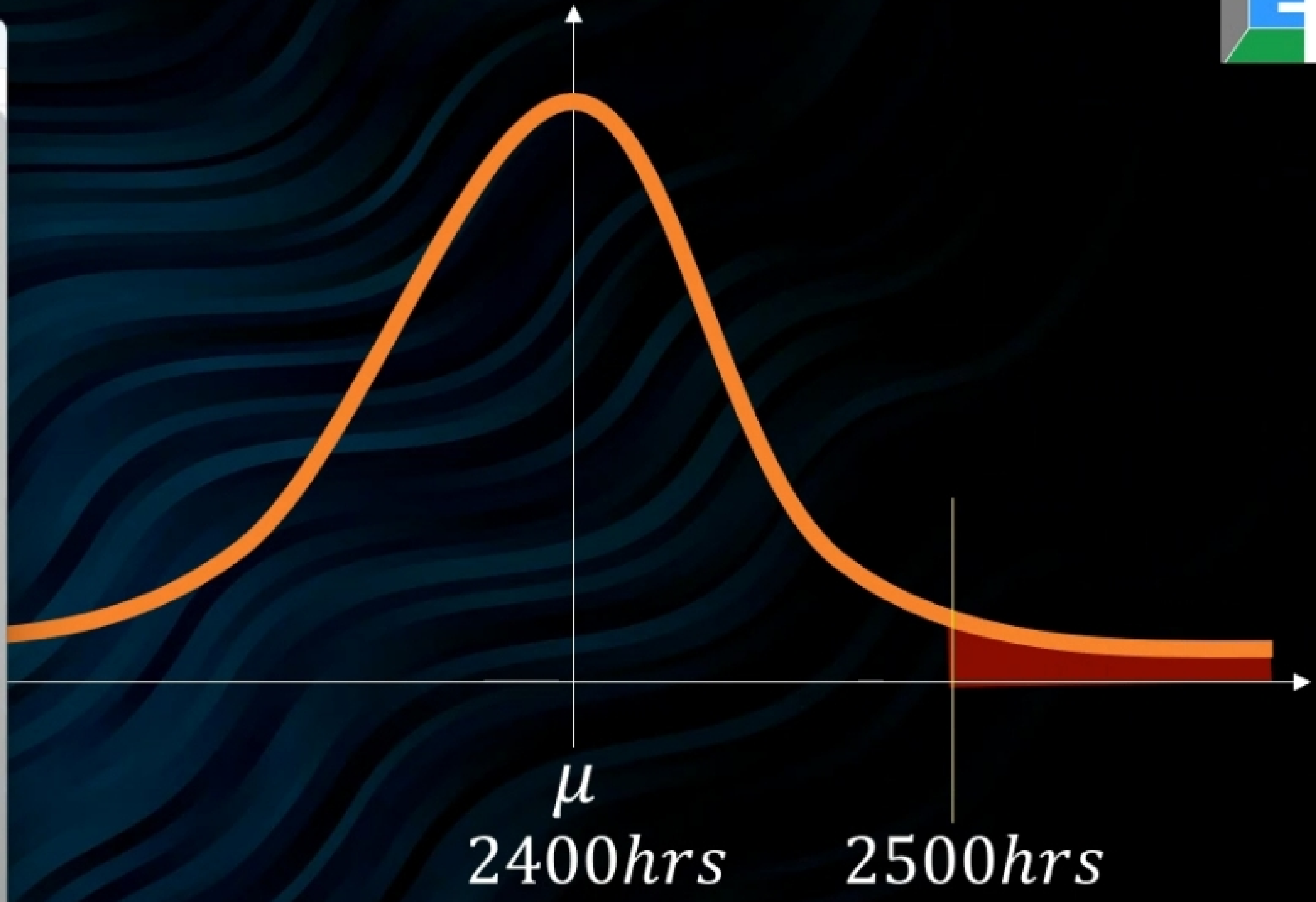
a) the mean time of fai be between 2300 2500hours if a random of 20 light bulbs is draw batch

b) How many light bulbs in between 2300 – 2500

c) What is the probabi the mean time of failure more than 2500 hours?

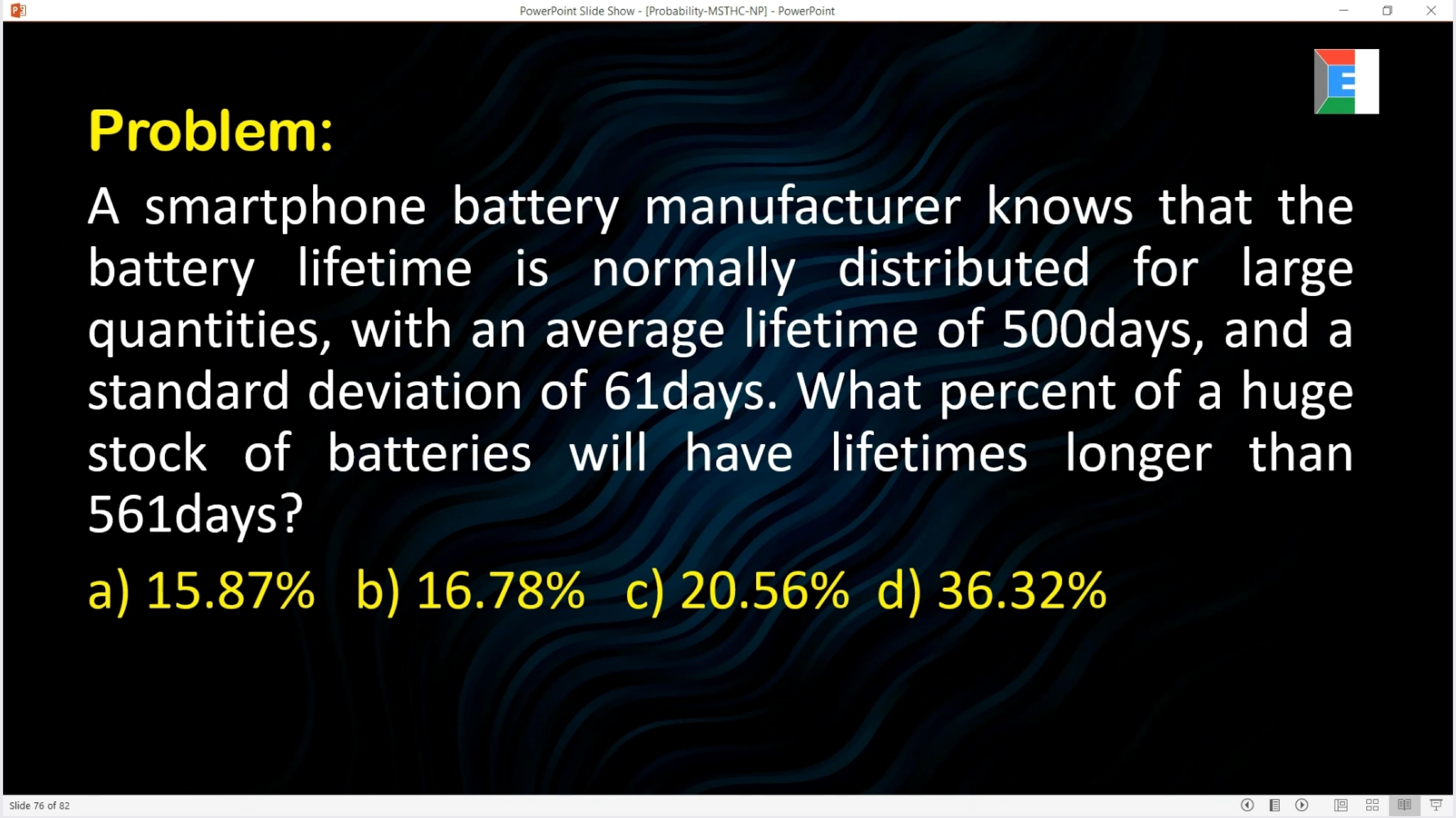


```
R(2500▸t)
                0.37733
```



$$P = \int_{2500}^{9500} \frac{1}{320\sqrt{2\pi}} e^{-\frac{\left(\frac{x-2400}{320}\right)^2}{2}} dx$$

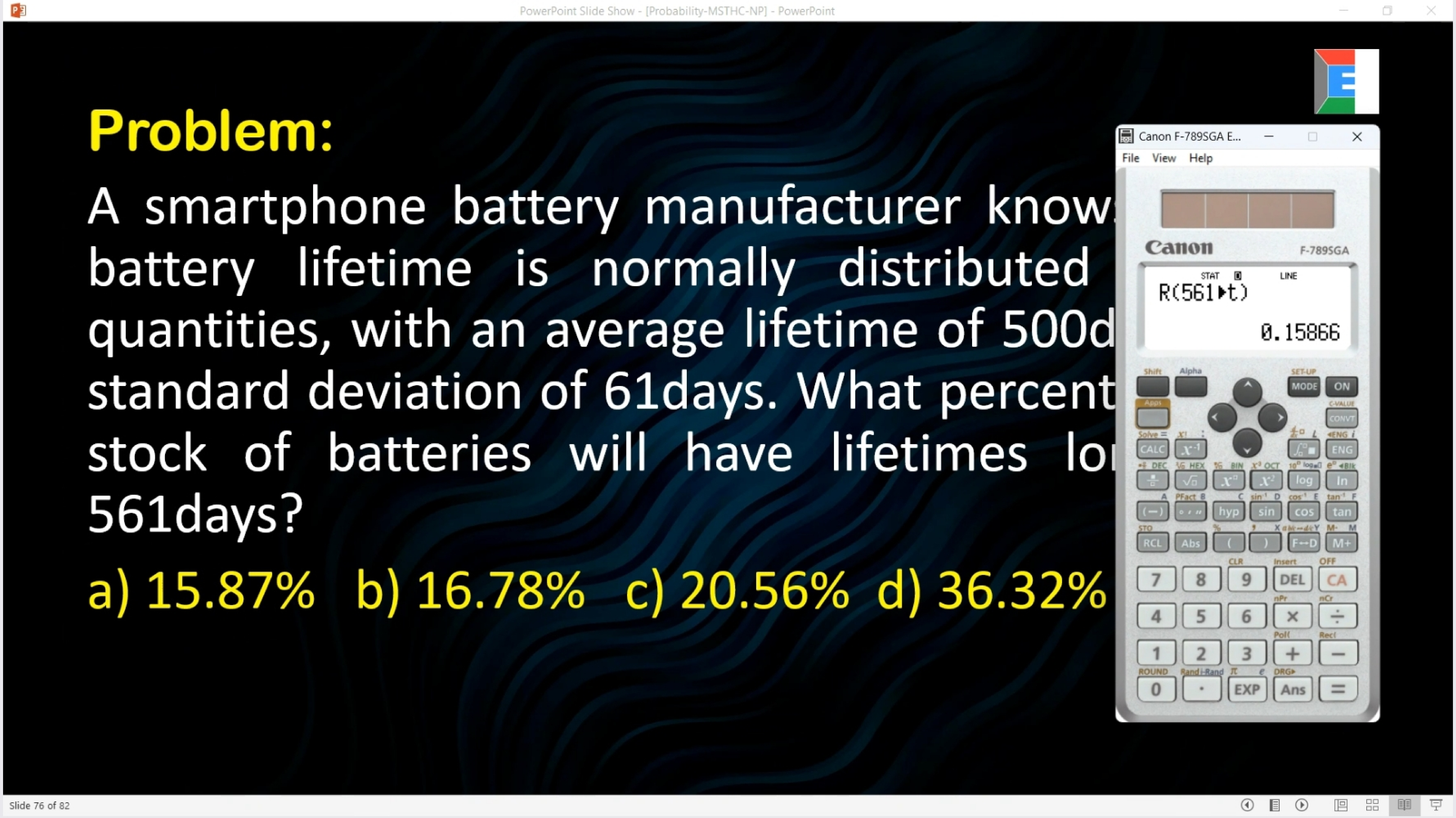
$$\boxed{P = 0.37733}$$


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 76 of 82

Problem:

A smartphone battery manufacturer knows that the battery lifetime is normally distributed for large quantities, with an average lifetime of 500days, and a standard deviation of 61days. What percent of a huge stock of batteries will have lifetimes longer than 561days?

a) 15.87% b) 16.78% c) 20.56% d) 36.32%


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
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Abs
M+
DEL
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EXP
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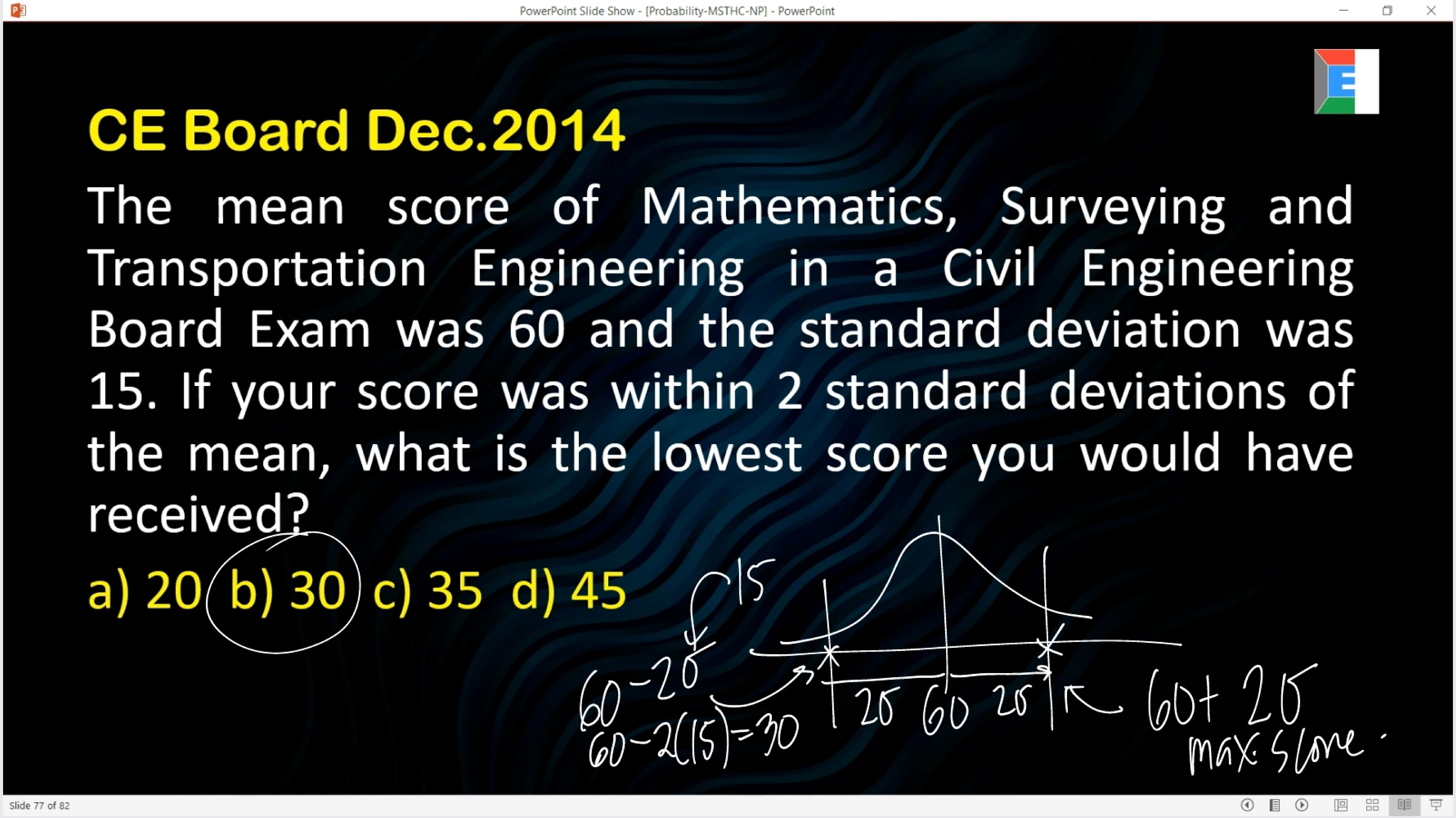
Slide 76 of 82

Problem:

A smartphone battery manufacturer know battery lifetime is normally distributed quantities, with an average lifetime of 500d standard deviation of 61days. What percent stock of batteries will have lifetimes lo 561days?

a) 15.87% b) 16.78% c) 20.56% d) 36.32%

```
R(561▶t)
                0.15866
```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Slide 77 of 82

CE Board Dec.2014

The mean score of Mathematics, Surveying and Transportation Engineering in a Civil Engineering Board Exam was 60 and the standard deviation was 15. If your score was within 2 standard deviations of the mean, what is the lowest score you would have received?

a) 20 [✓ b) 30] c) 35 d) 45

$\sigma = 15$

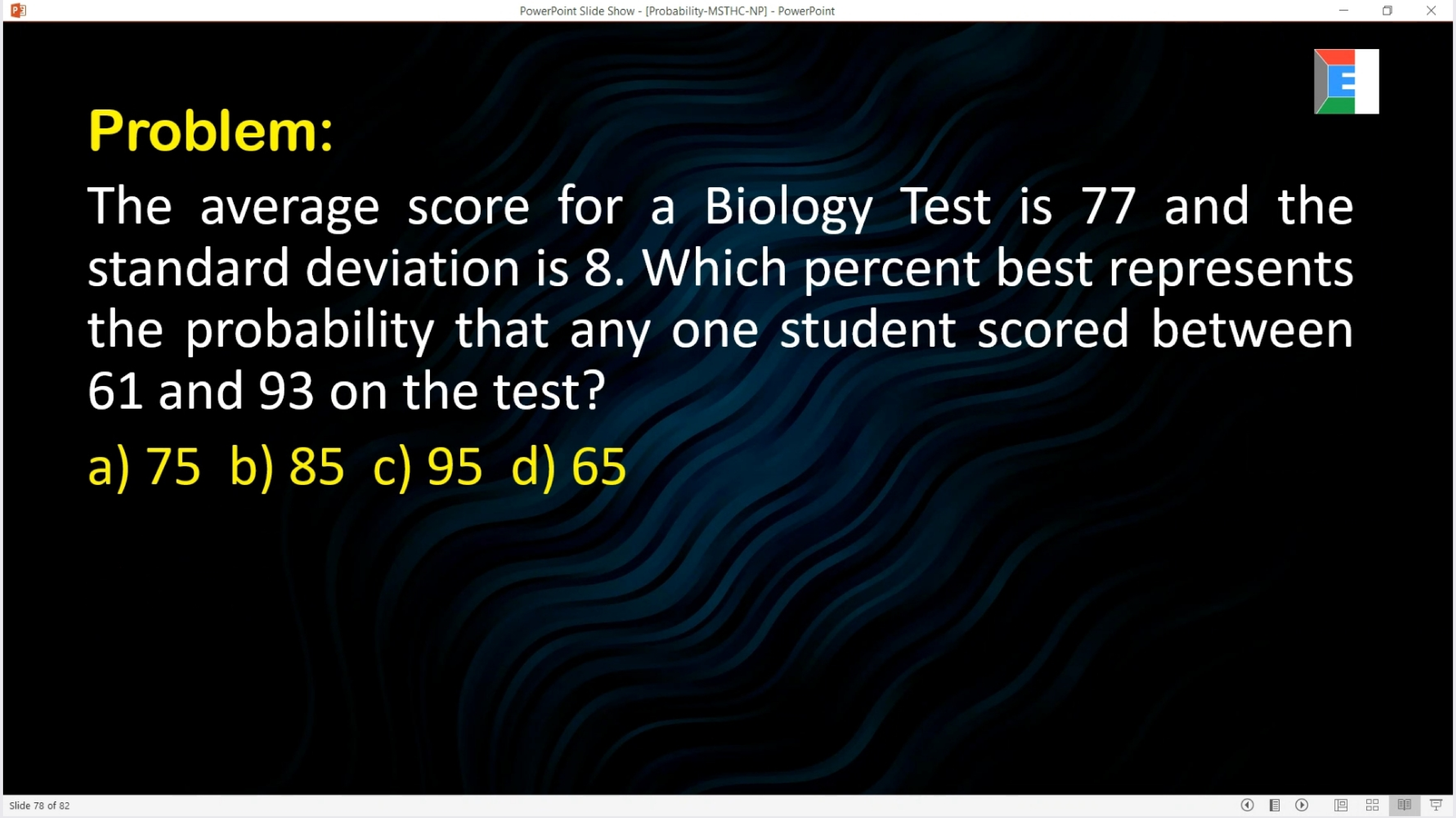
$60 - 2\sigma$

$60 - 2(15) = 30$

2σ
60
2σ

$60 + 2\sigma$

max score


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 78 of 82

Problem:

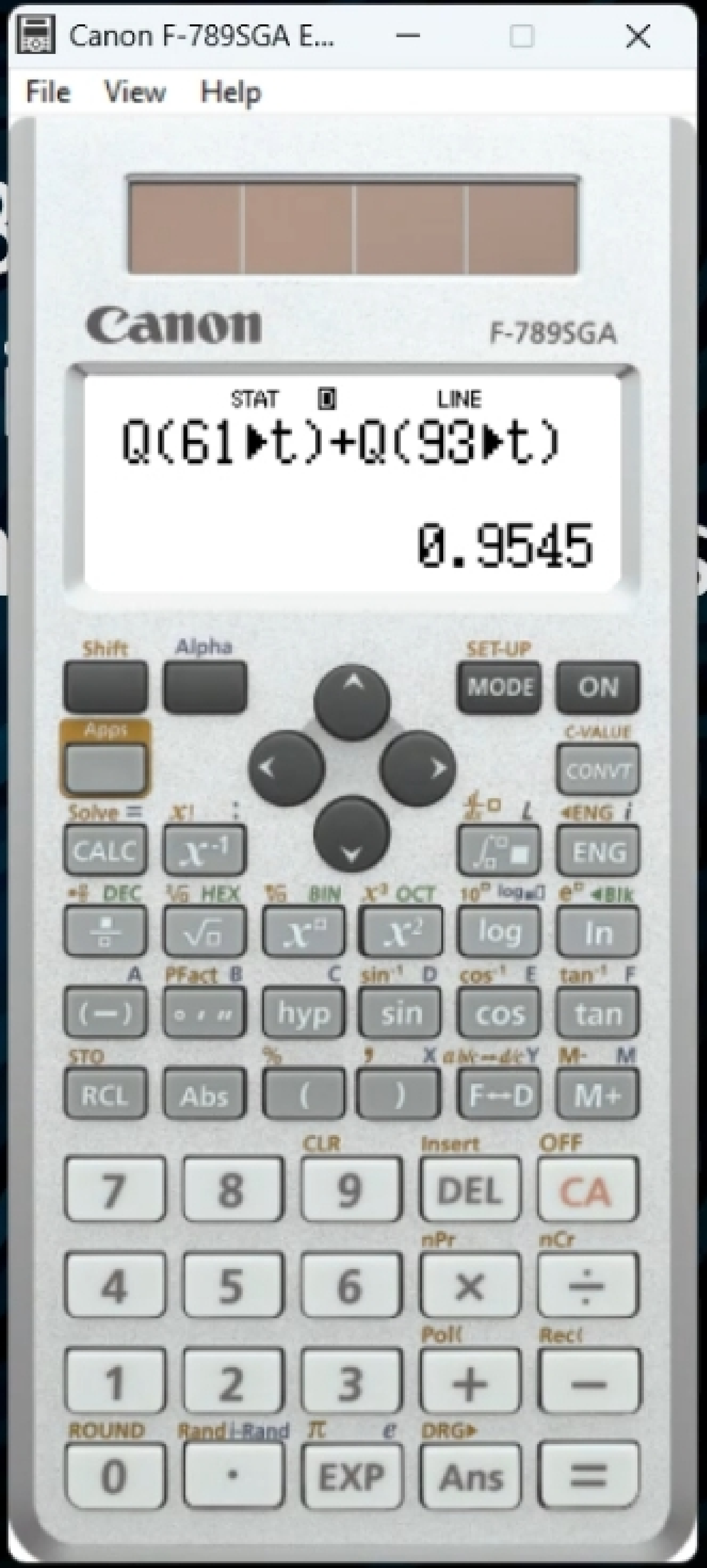
The average score for a Biology Test is 77 and the standard deviation is 8. Which percent best represents the probability that any one student scored between 61 and 93 on the test?

a) 75 b) 85 c) 95 d) 65

Problem:

The average score for a B … is 77 and the standard deviation is 8. Whi … best represents the probability that any on … scored between 61 and 93 on the test?

a) 75 b) 85 c) 95 d) 65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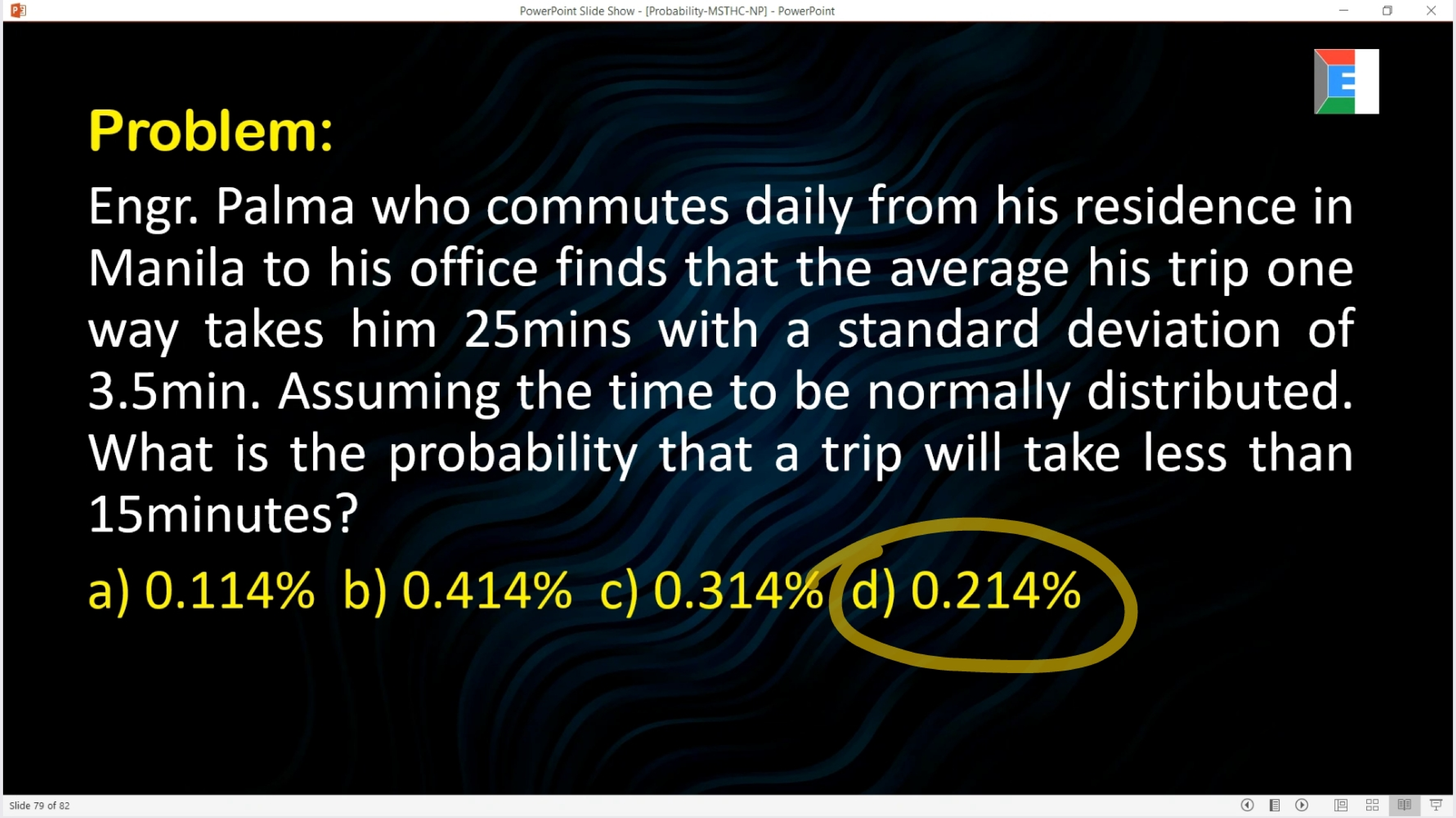
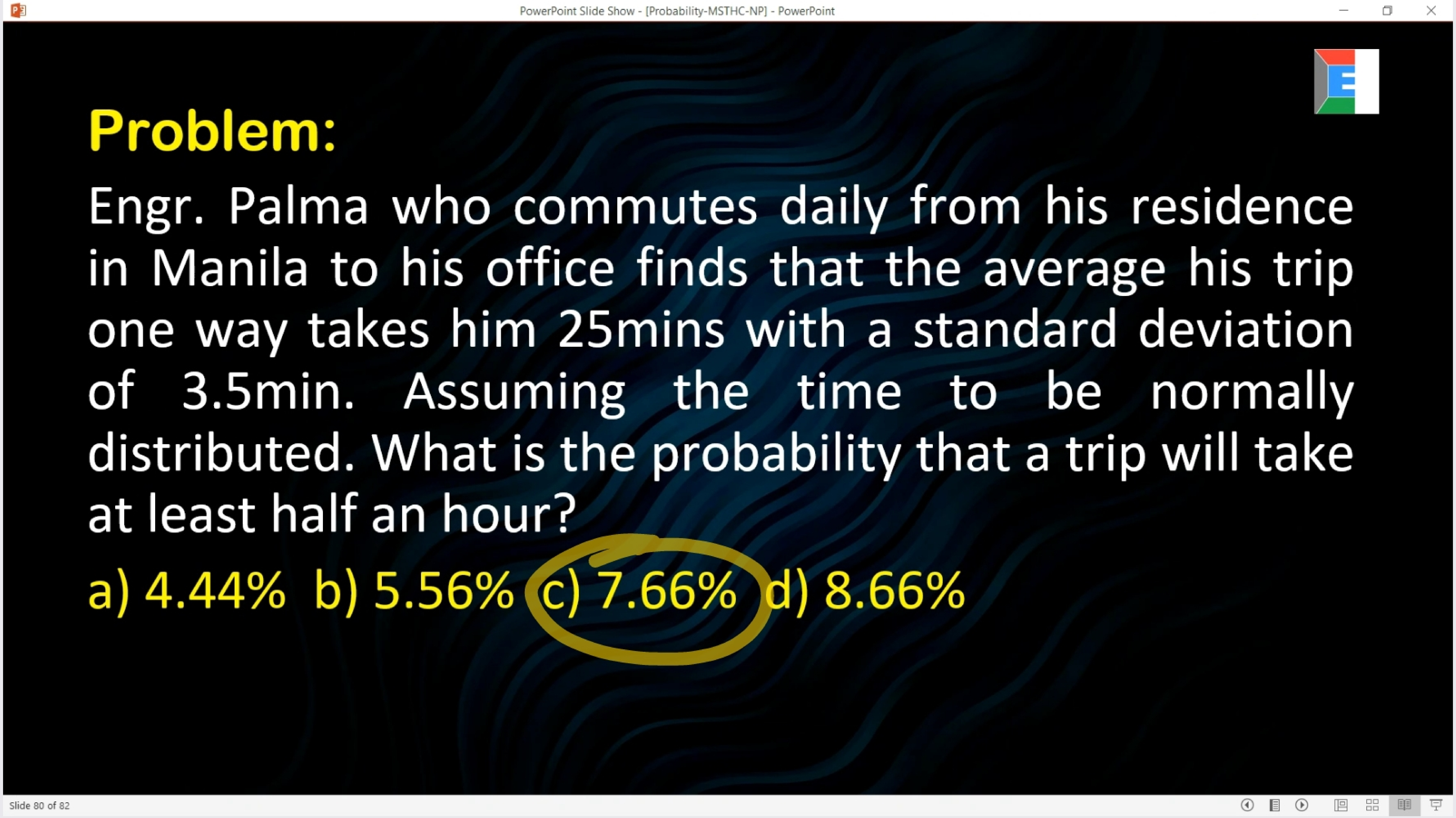
```
Q(61▸t)+Q(93▸t)
                 0.9545
```


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 79 of 82

Problem:

Engr. Palma who commutes daily from his residence in Manila to his office finds that the average his trip one way takes him 25mins with a standard deviation of 3.5min. Assuming the time to be normally distributed. What is the probability that a trip will take less than 15minutes?

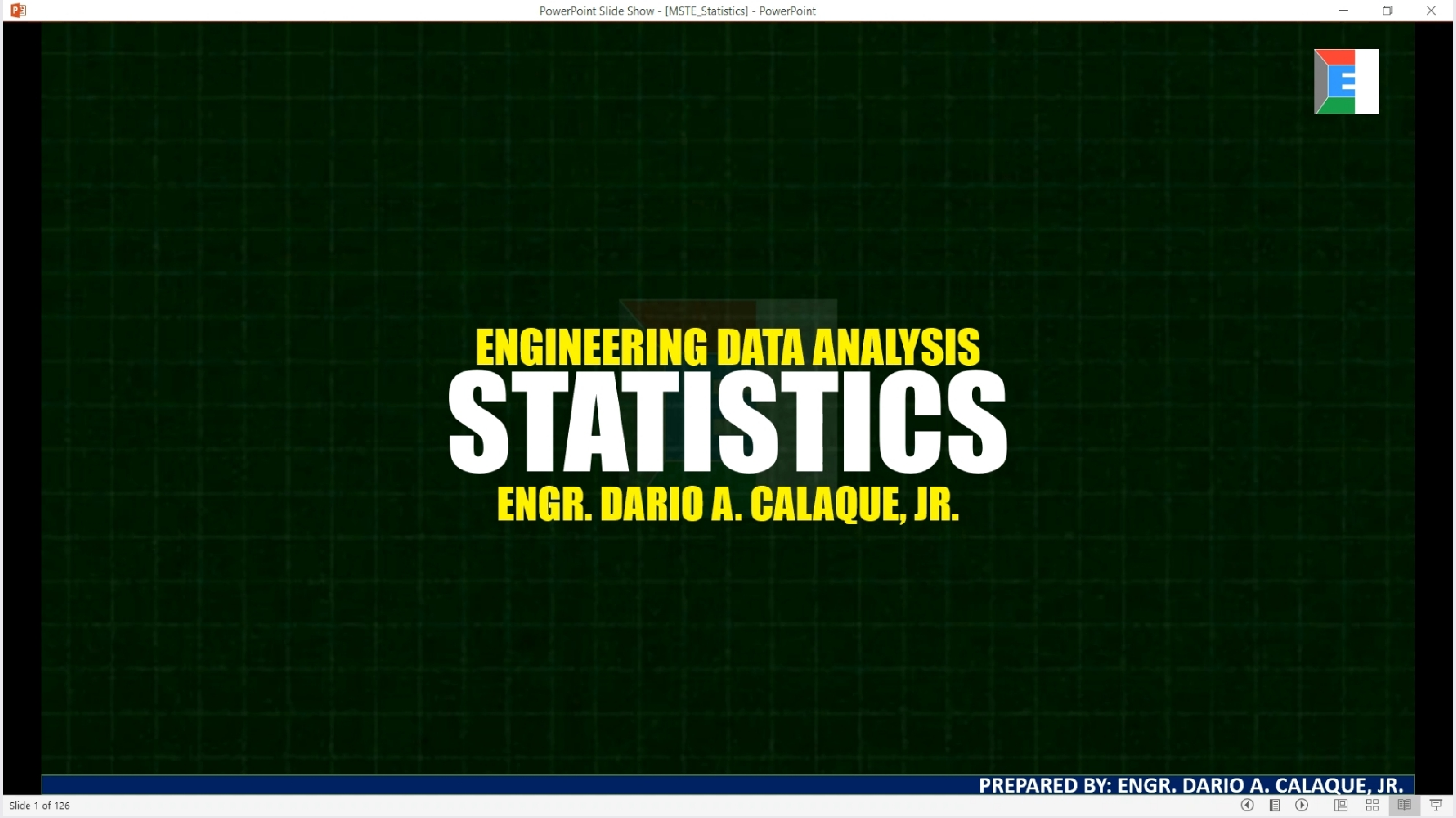
a) 0.114% b) 0.414% c) 0.314% [✓ d) 0.214%]


PowerPoint Slide Show - [Probability-MSTHC-NP] - PowerPoint
Slide 80 of 82

Problem:

Engr. Palma who commutes daily from his residence in Manila to his office finds that the average his trip one way takes him 25mins with a standard deviation of 3.5min. Assuming the time to be normally distributed. What is the probability that a trip will take at least half an hour?

a) 4.44% b) 5.56% [✓ c) 7.66%] d) 8.66%

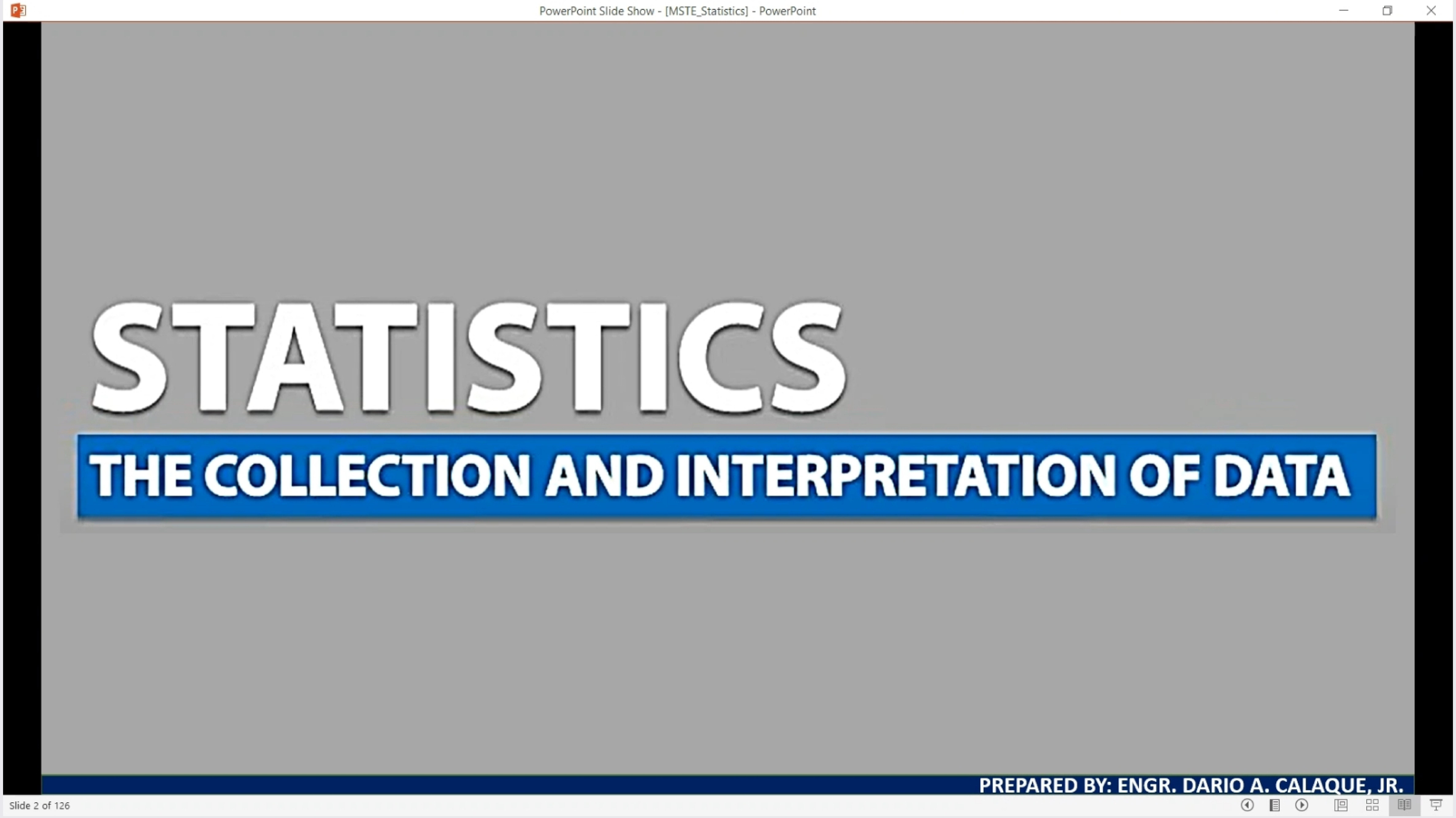

PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
Slide 1 of 126

ENGINEERING DATA ANALYSIS

STATISTICS

ENGR. DARIO A. CALAQUE, JR.

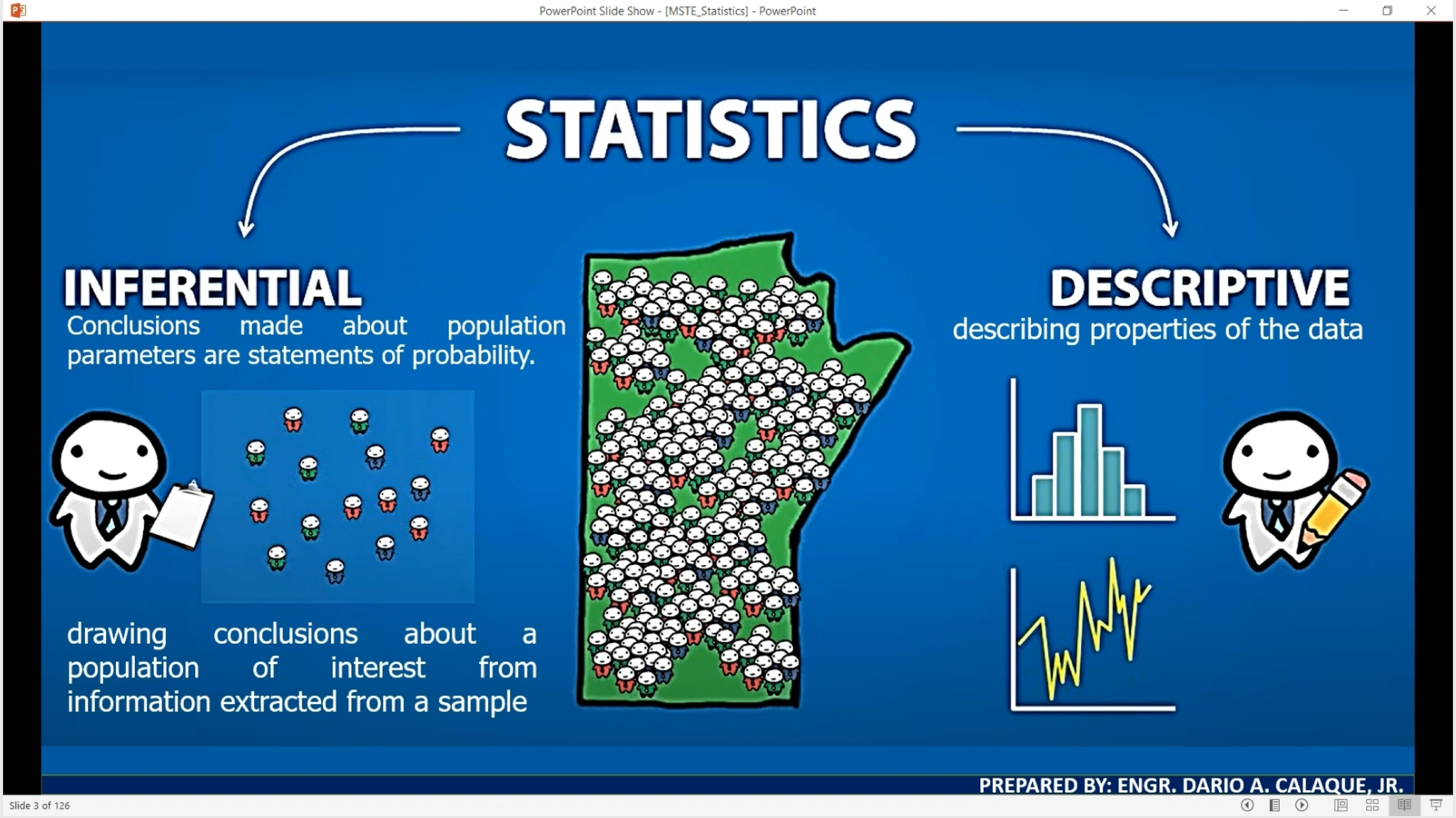
PREPARED BY: ENGR. DARIO A. CALAQUE, JR.


PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
Slide 2 of 126

STATISTICS

THE COLLECTION AND INTERPRETATION OF DATA

PREPARED BY: ENGR. DARIO A. CALAQUE, JR.


PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
Slide 3 of 126

STATISTICS

INFERENTIAL

Conclusions made about population parameters are statements of probability.

drawing conclusions about a population of interest from information extracted from a sample

DESCRIPTIVE

describing properties of the data

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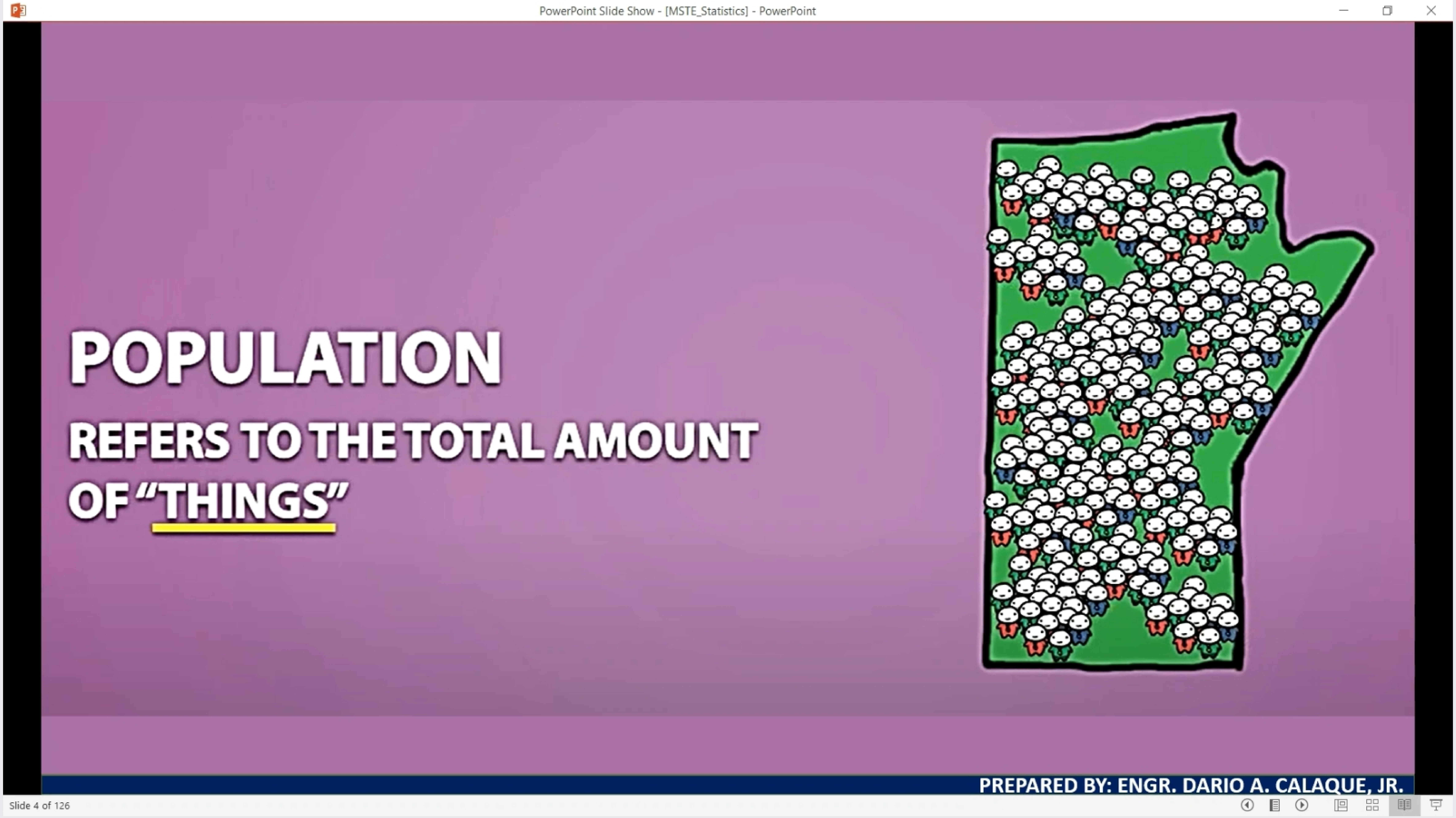
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POPULATION

REFERS TO THE TOTAL AMOUNT OF "THINGS"

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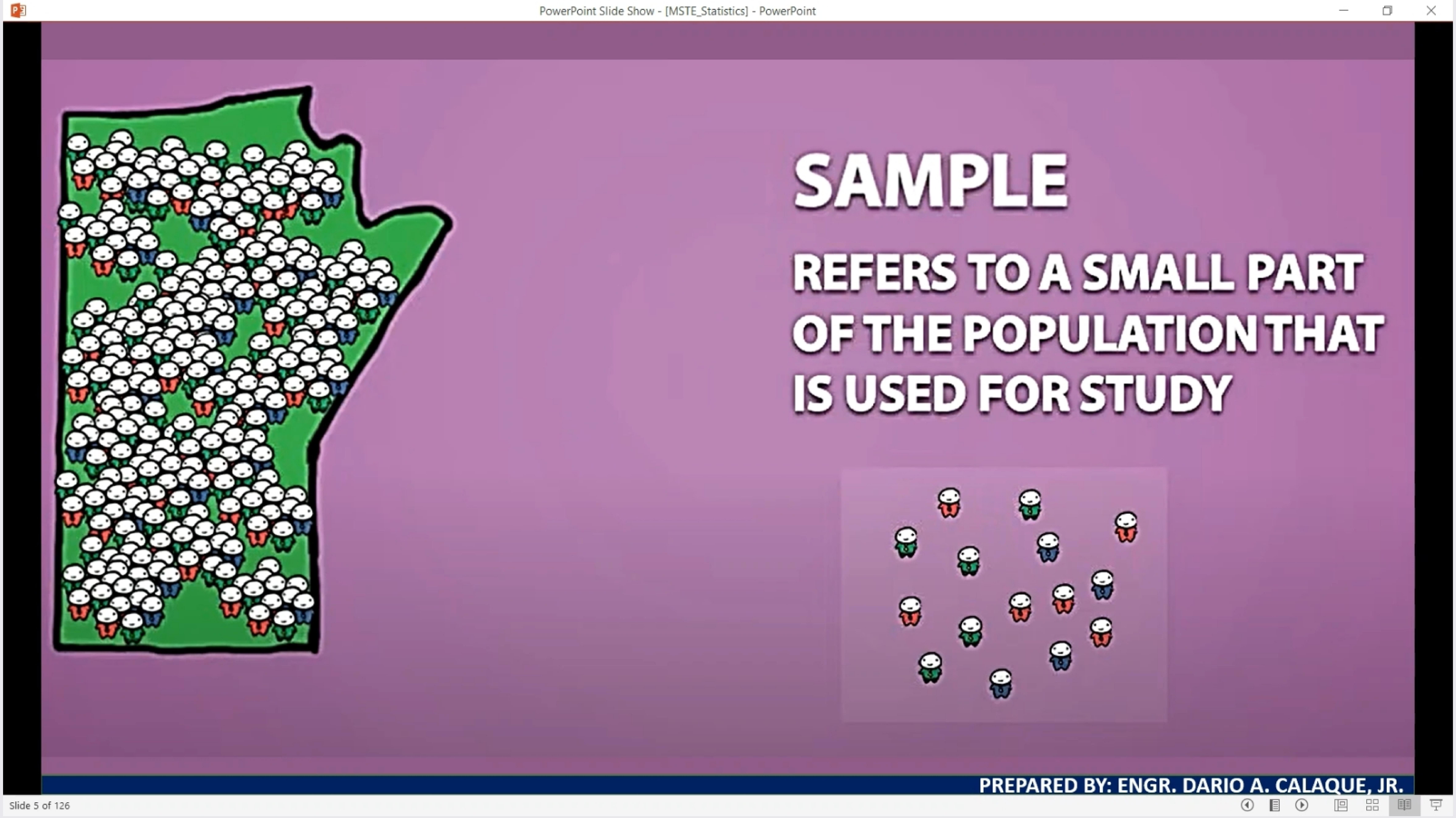

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SAMPLE

REFERS TO A SMALL PART OF THE POPULATION THAT IS USED FOR STUDY

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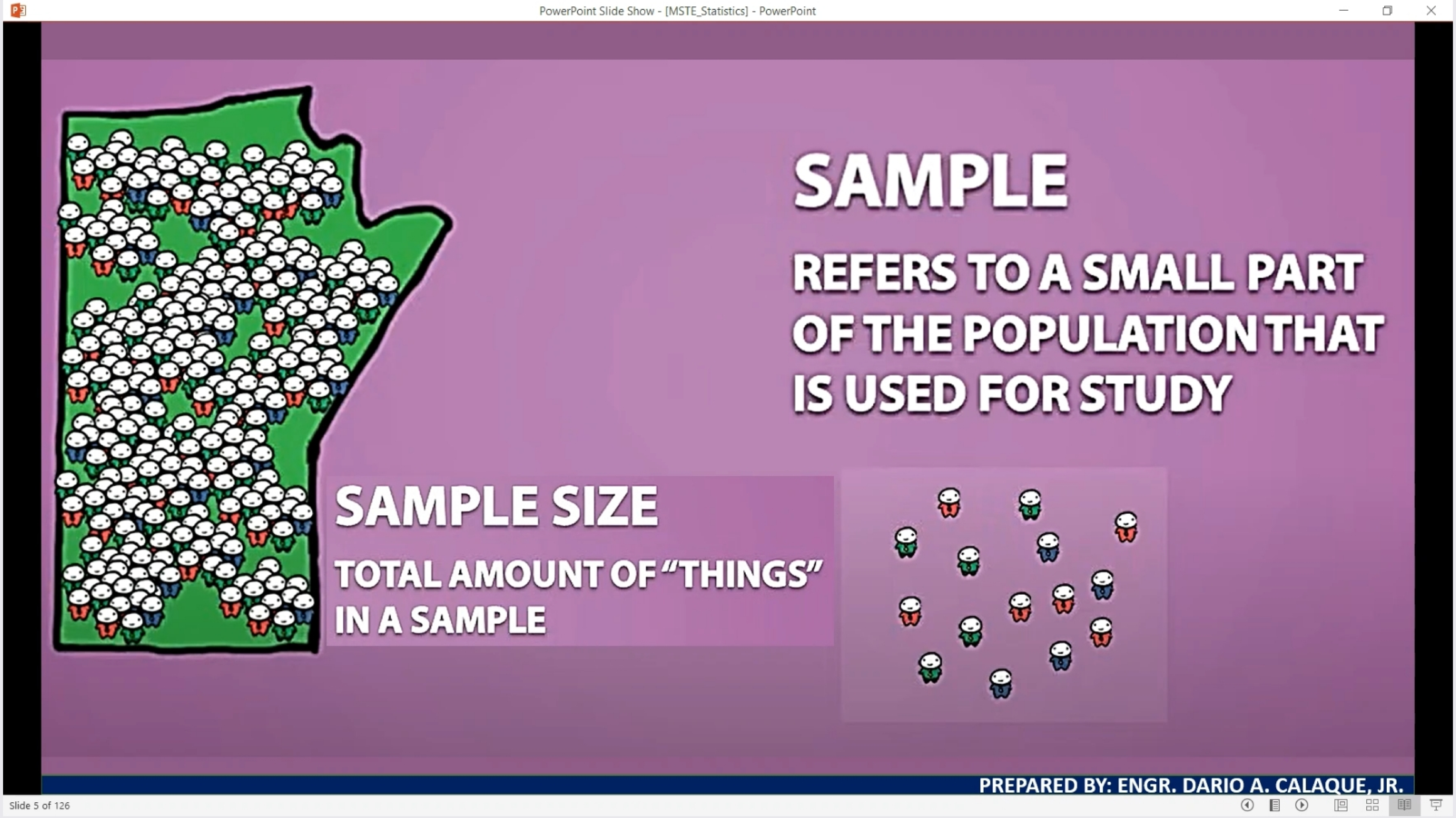
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SAMPLE

REFERS TO A SMALL PART OF THE POPULATION THAT IS USED FOR STUDY

SAMPLE SIZE

TOTAL AMOUNT OF "THINGS" IN A SAMPLE

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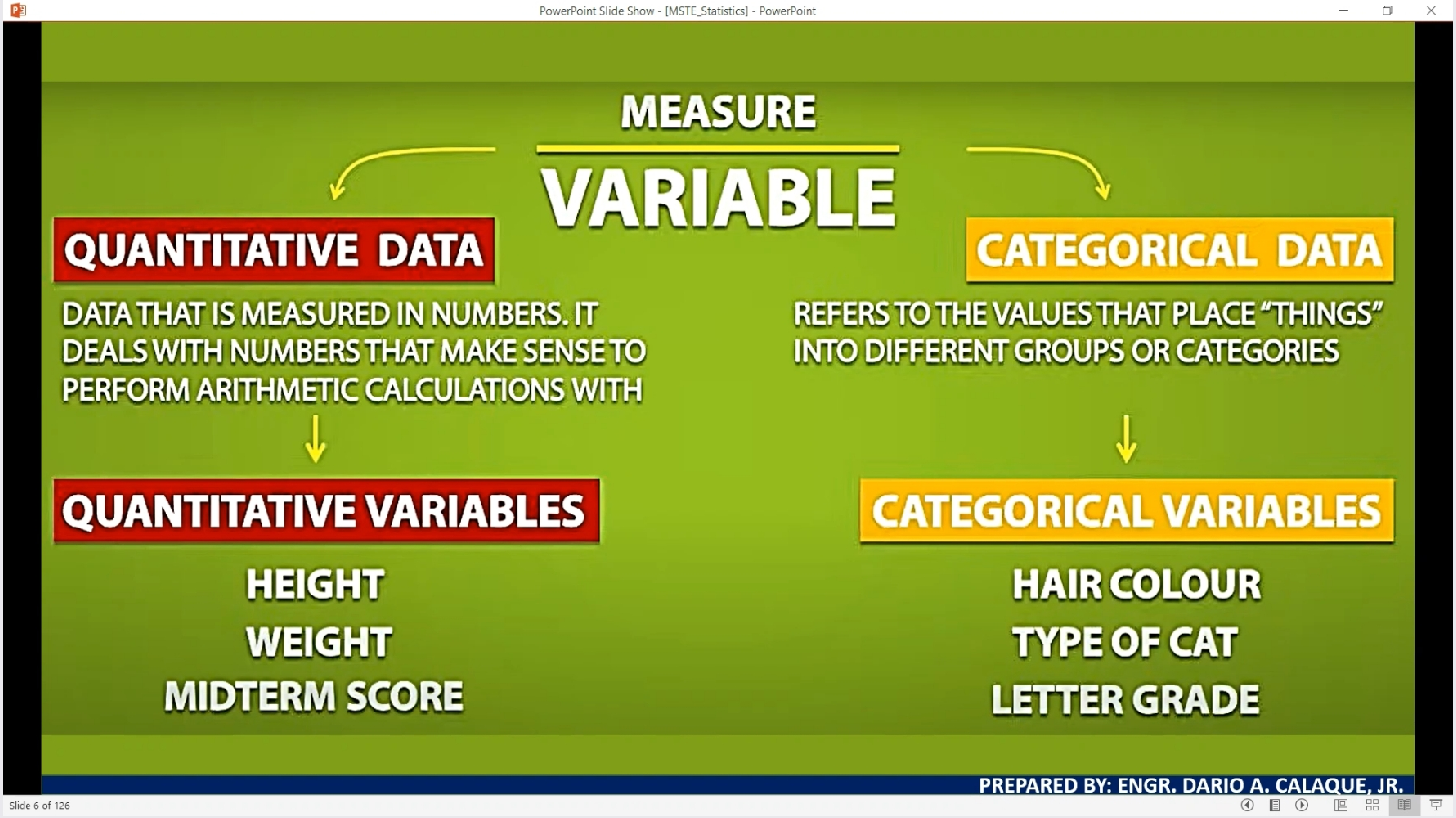
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MEASURE

VARIABLE

QUANTITATIVE DATA

DATA THAT IS MEASURED IN NUMBERS. IT DEALS WITH NUMBERS THAT MAKE SENSE TO PERFORM ARITHMETIC CALCULATIONS WITH

QUANTITATIVE VARIABLES

HEIGHT
WEIGHT
MIDTERM SCORE

CATEGORICAL DATA

REFERS TO THE VALUES THAT PLACE “THINGS” INTO DIFFERENT GROUPS OR CATEGORIES

CATEGORICAL VARIABLES

HAIR COLOUR
TYPE OF CAT
LETTER GRADE

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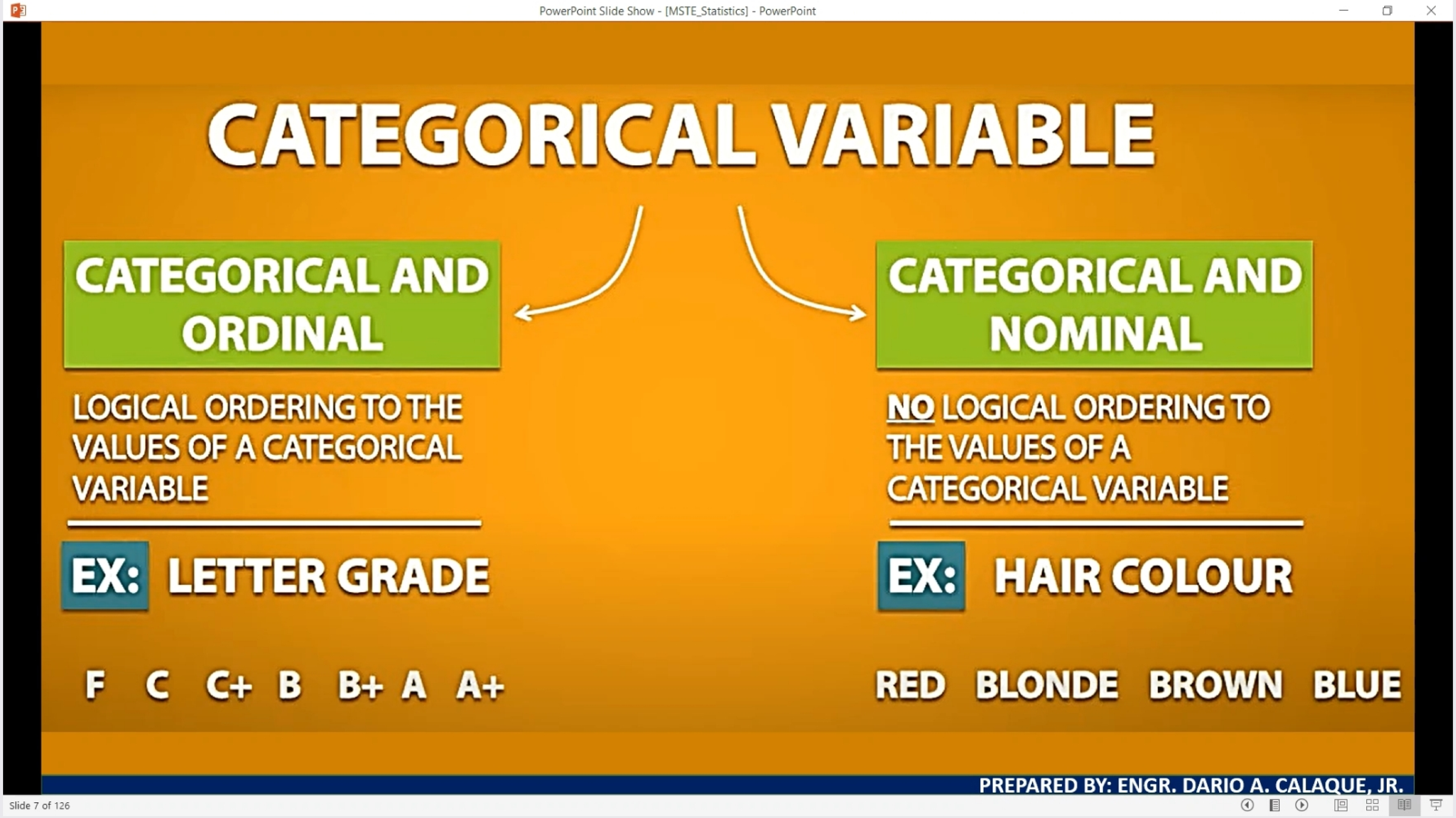
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CATEGORICAL VARIABLE

CATEGORICAL AND ORDINAL

LOGICAL ORDERING TO THE VALUES OF A CATEGORICAL VARIABLE

EX: LETTER GRADE

F C C+ B B+ A A+

CATEGORICAL AND NOMINAL

NO LOGICAL ORDERING TO THE VALUES OF A CATEGORICAL VARIABLE

EX: HAIR COLOUR

RED BLONDE BROWN BLUE

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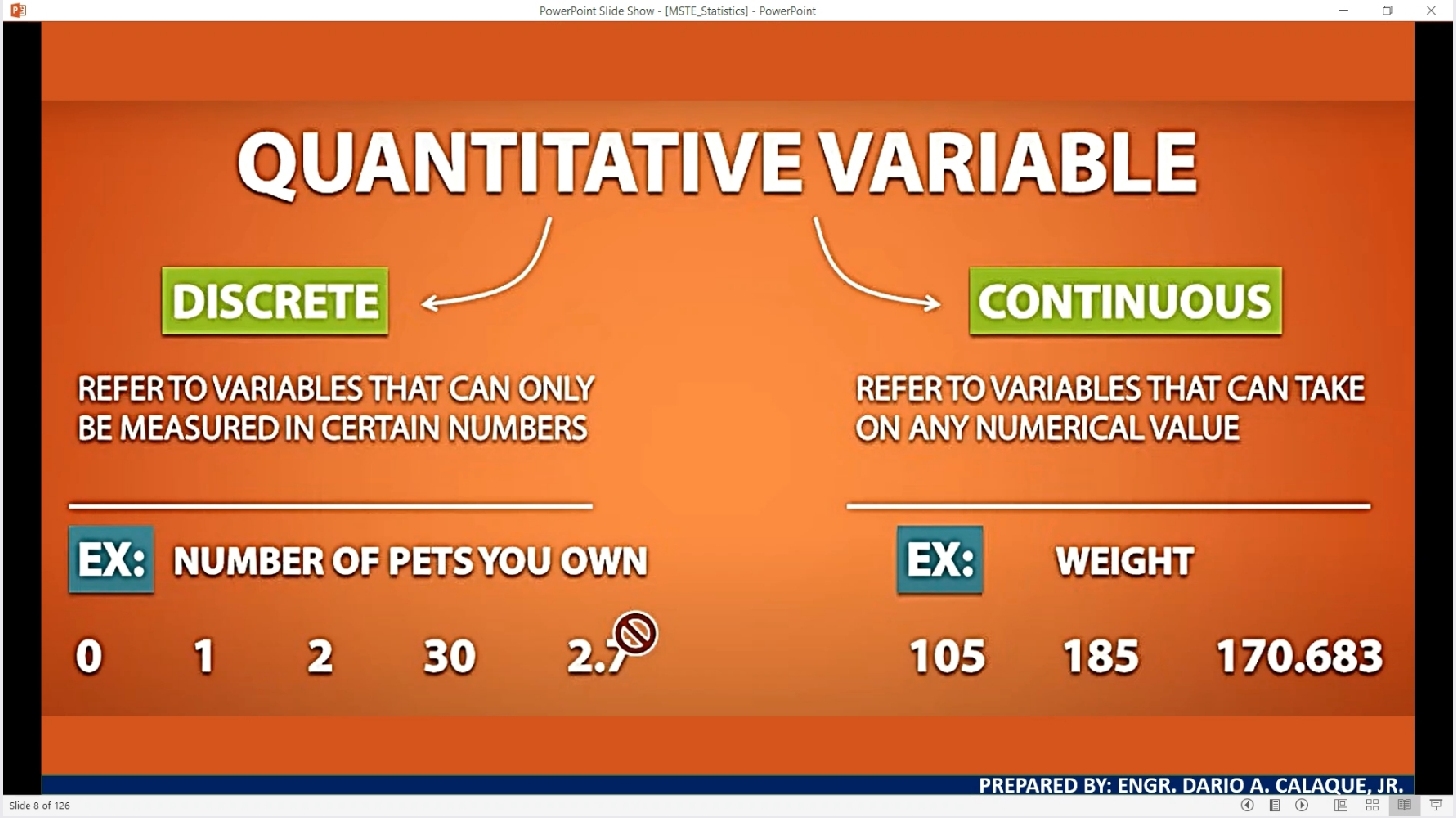
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QUANTITATIVE VARIABLE

DISCRETE

REFER TO VARIABLES THAT CAN ONLY BE MEASURED IN CERTAIN NUMBERS

EX: NUMBER OF PETS YOU OWN

0 1 2 30 2.7 🚫

CONTINUOUS

REFER TO VARIABLES THAT CAN TAKE ON ANY NUMERICAL VALUE

EX: WEIGHT

105 185 170.683

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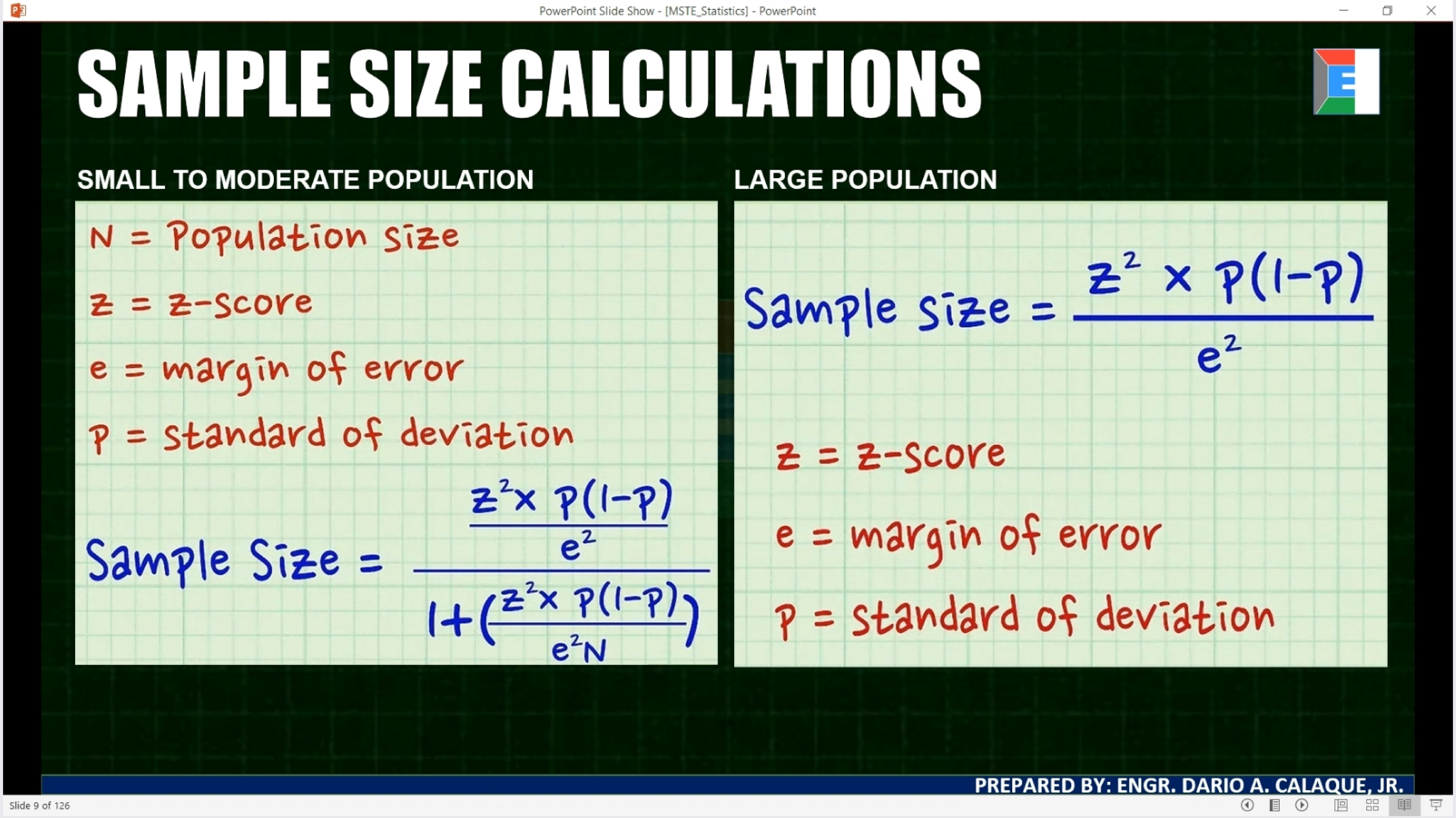
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SAMPLE SIZE CALCULATIONS

SMALL TO MODERATE POPULATION

N = Population size

z = z-score

e = margin of error

p = standard of deviation

$$\text{Sample Size} = \frac{\dfrac{z^2 \times p(1-p)}{e^2}}{1+\left(\dfrac{z^2 \times p(1-p)}{e^2 N}\right)}$$

LARGE POPULATION

$$\text{Sample size} = \frac{z^2 \times p(1-p)}{e^2}$$

z = z-score

e = margin of error

p = standard of deviation

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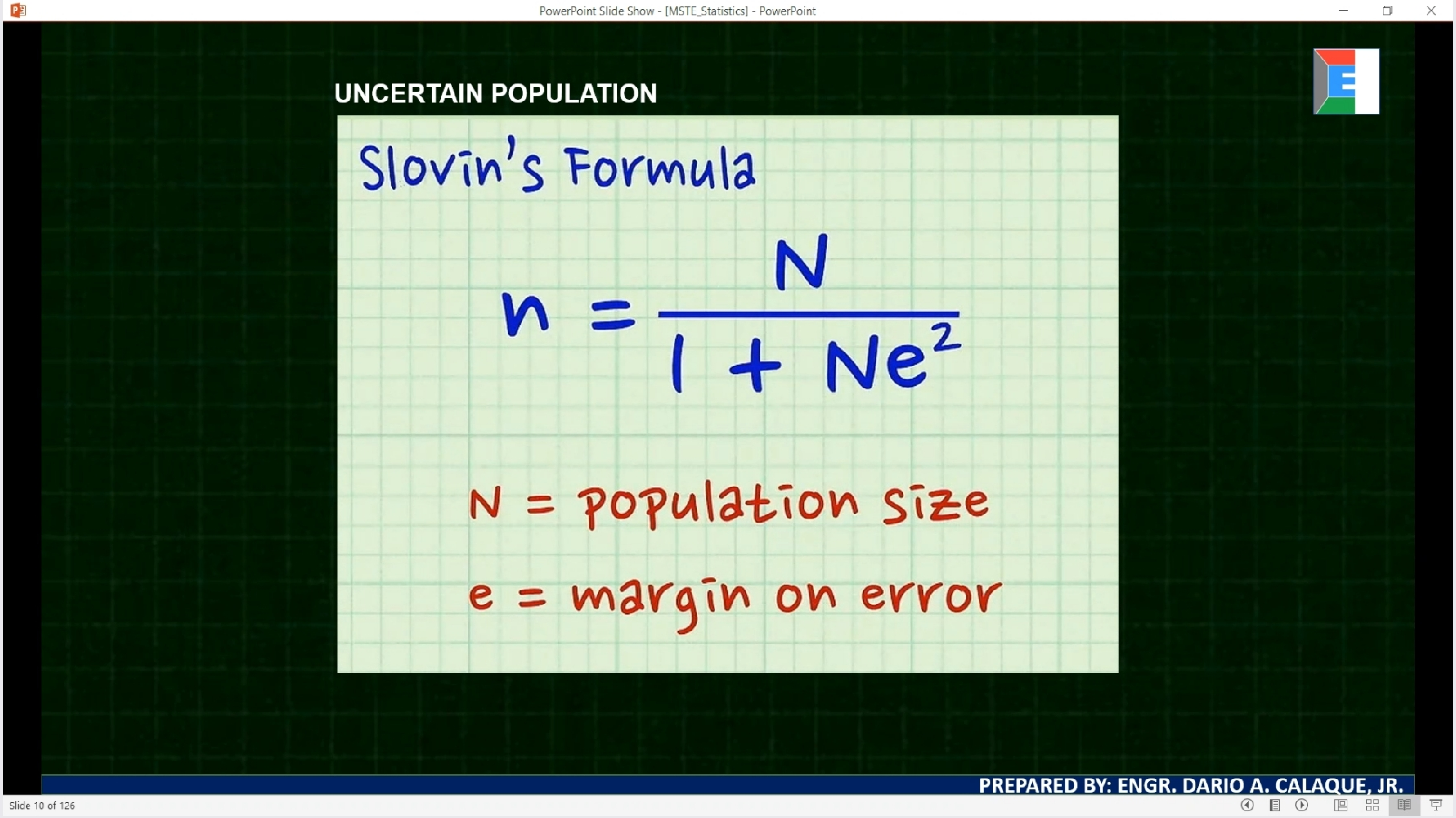
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UNCERTAIN POPULATION

Slovin's Formula

$$n = \frac{N}{1 + Ne^2}$$

N = population size

e = margin on error

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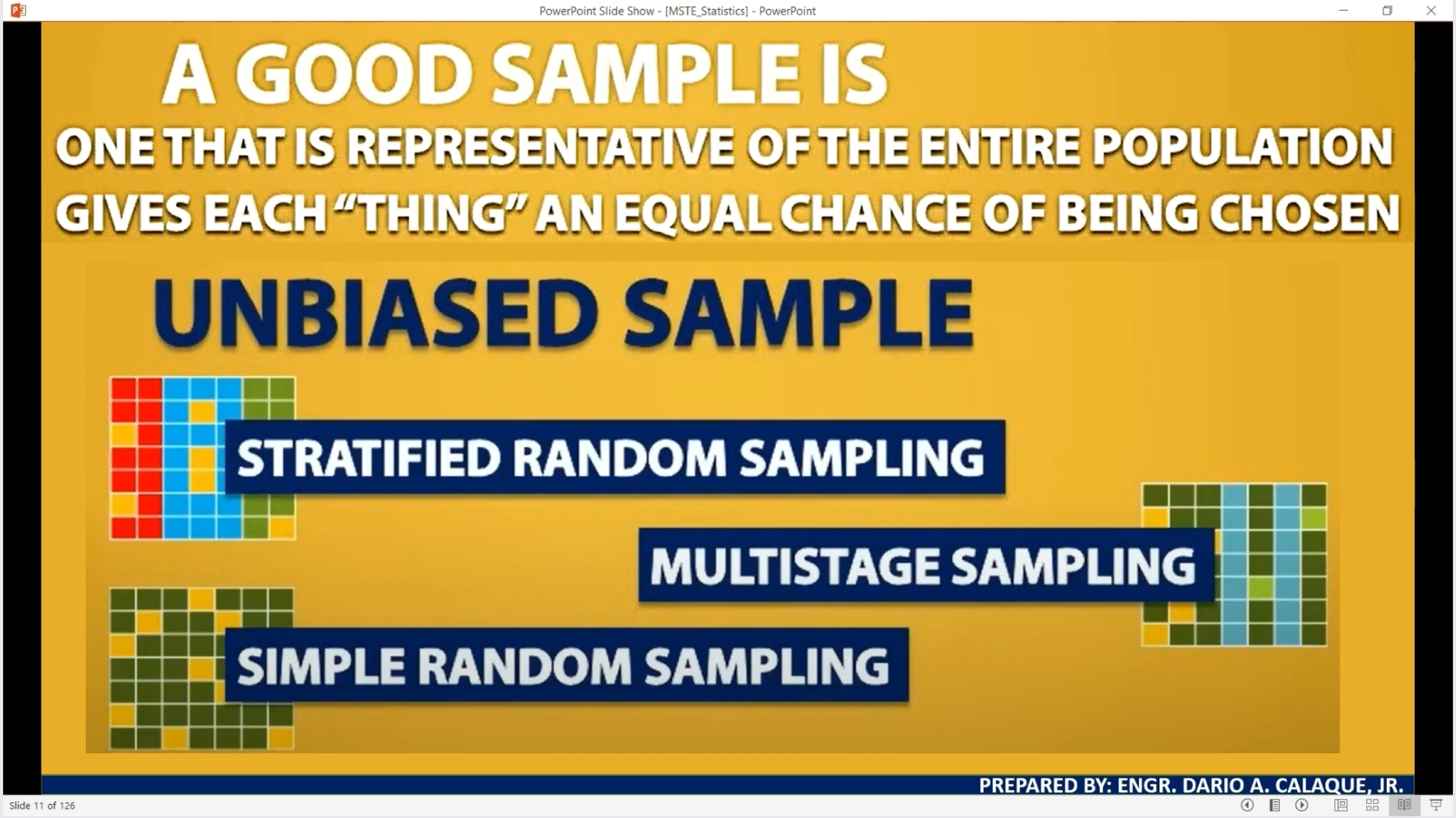
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A GOOD SAMPLE IS

ONE THAT IS REPRESENTATIVE OF THE ENTIRE POPULATION

GIVES EACH "THING" AN EQUAL CHANCE OF BEING CHOSEN

UNBIASED SAMPLE

STRATIFIED RANDOM SAMPLING

MULTISTAGE SAMPLING

SIMPLE RANDOM SAMPLING

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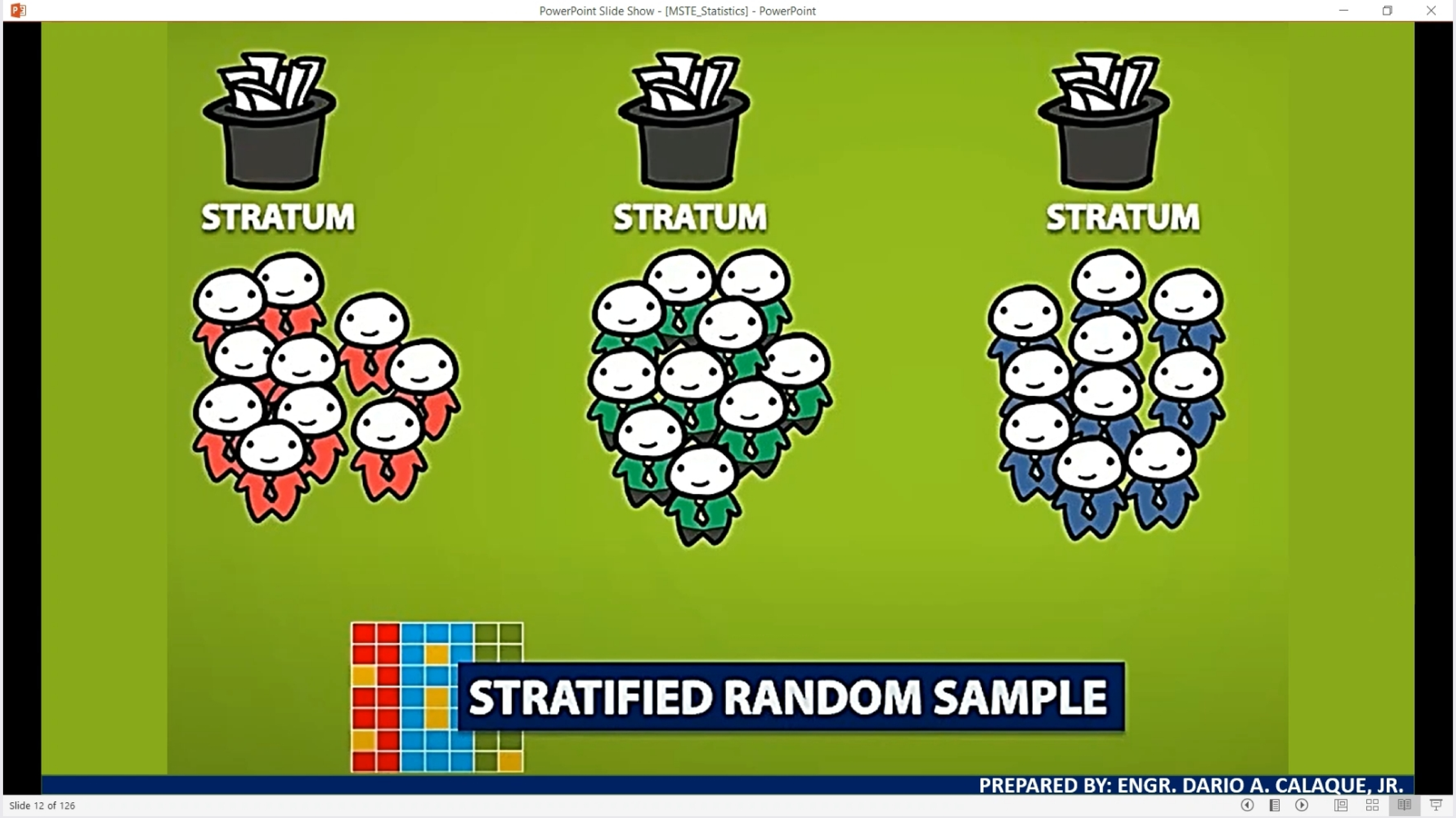
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STRATUM

STRATUM

STRATUM

STRATIFIED RANDOM SAMPLE

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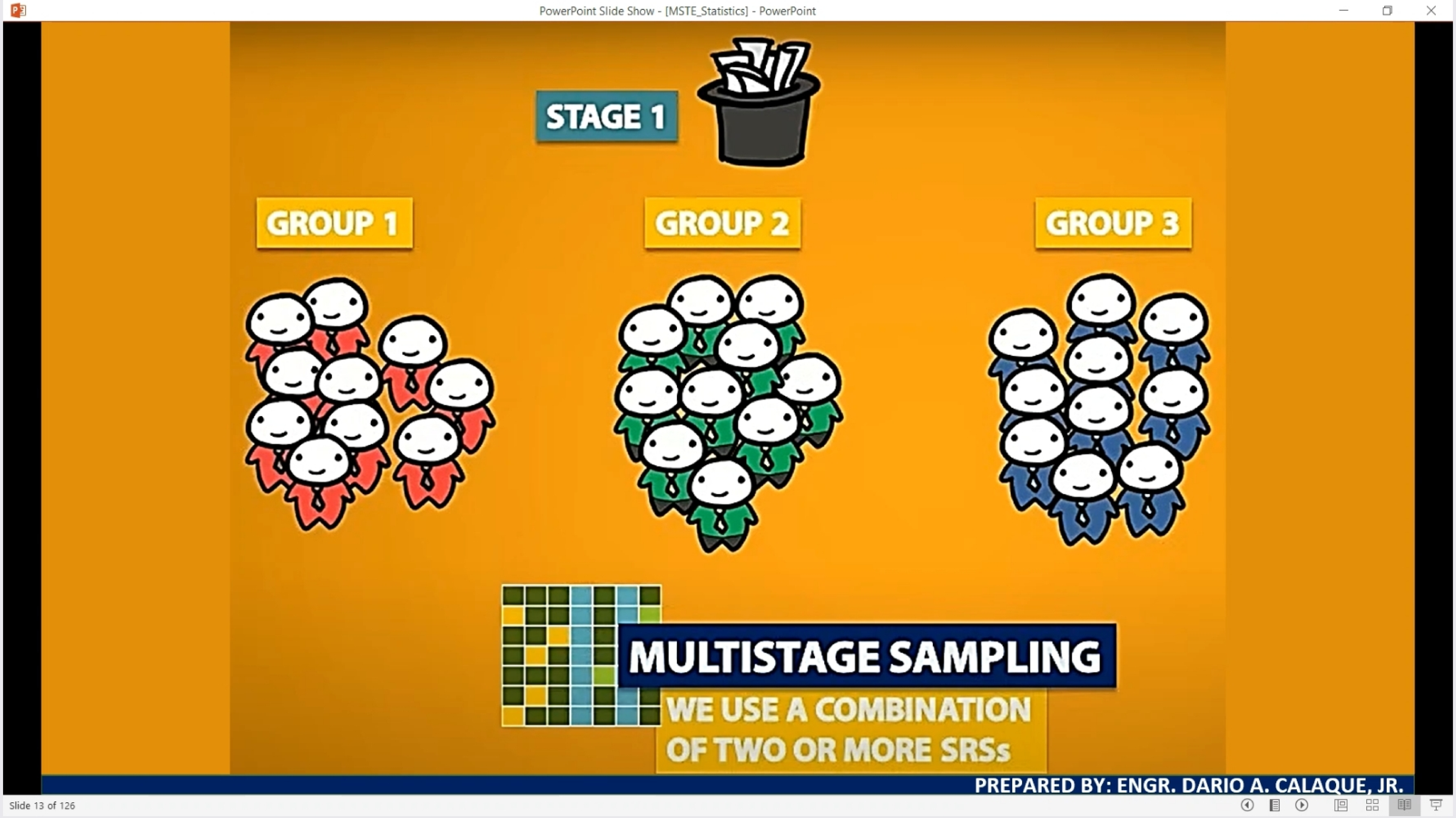
PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
STAGE 1
GROUP 1
GROUP 2
GROUP 3
Slide 13 of 126

MULTISTAGE SAMPLING

WE USE A COMBINATION
OF TWO OR MORE SRSs

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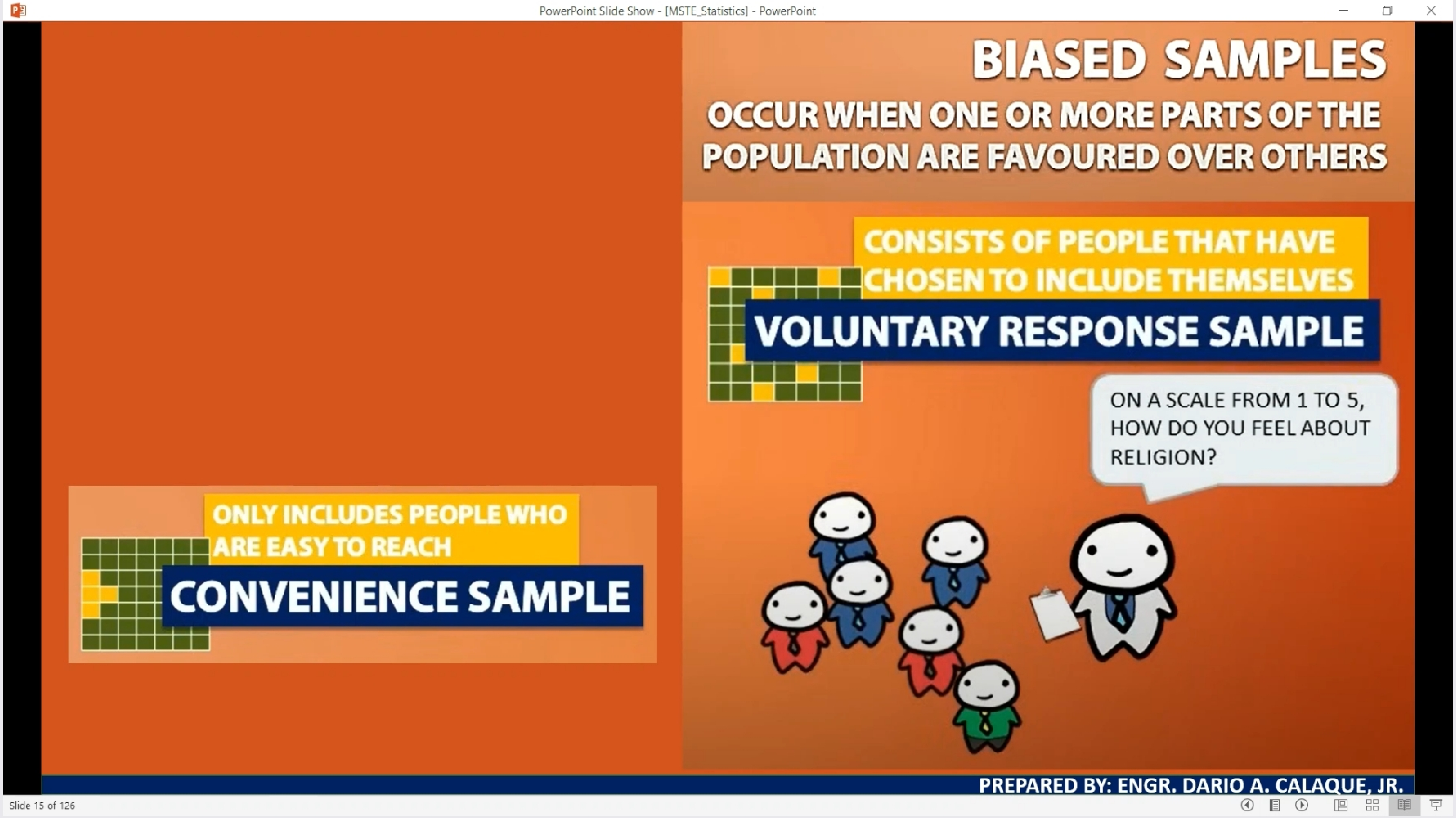
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BIASED SAMPLES

OCCUR WHEN ONE OR MORE PARTS OF THE POPULATION ARE FAVOURED OVER OTHERS

CONSISTS OF PEOPLE THAT HAVE CHOSEN TO INCLUDE THEMSELVES

VOLUNTARY RESPONSE SAMPLE

ON A SCALE FROM 1 TO 5, HOW DO YOU FEEL ABOUT RELIGION?

ONLY INCLUDES PEOPLE WHO ARE EASY TO REACH

CONVENIENCE SAMPLE

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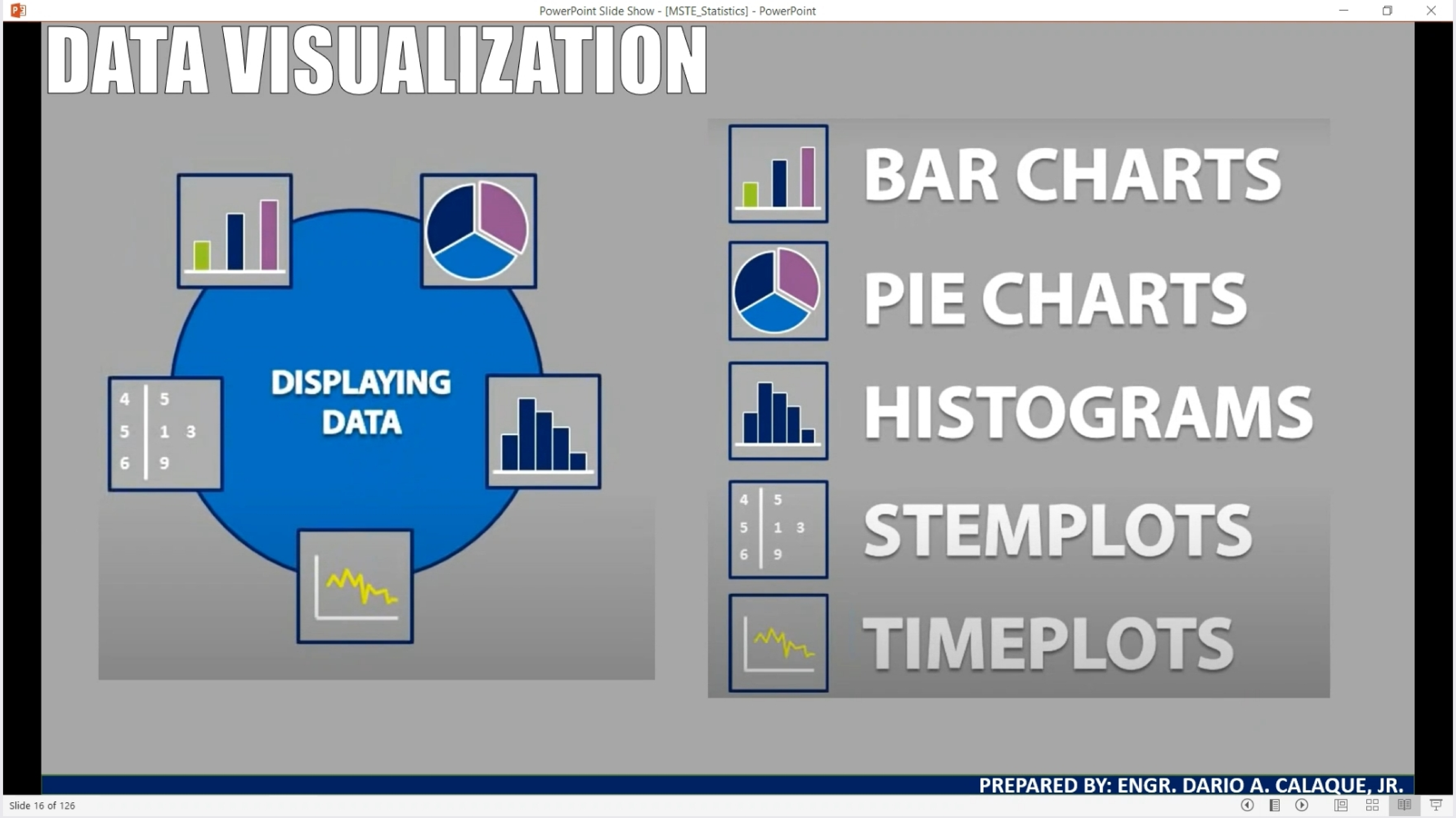
Slide 15 of 126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4 | 5
5 | 1 3
6 | 9
Slide 16 of 126

DATA VISUALIZATION

DISPLAYING DATA

- BAR CHARTS
- PIE CHARTS
- HISTOGRAMS
- STEMPLOTS
- TIMEPLOTS

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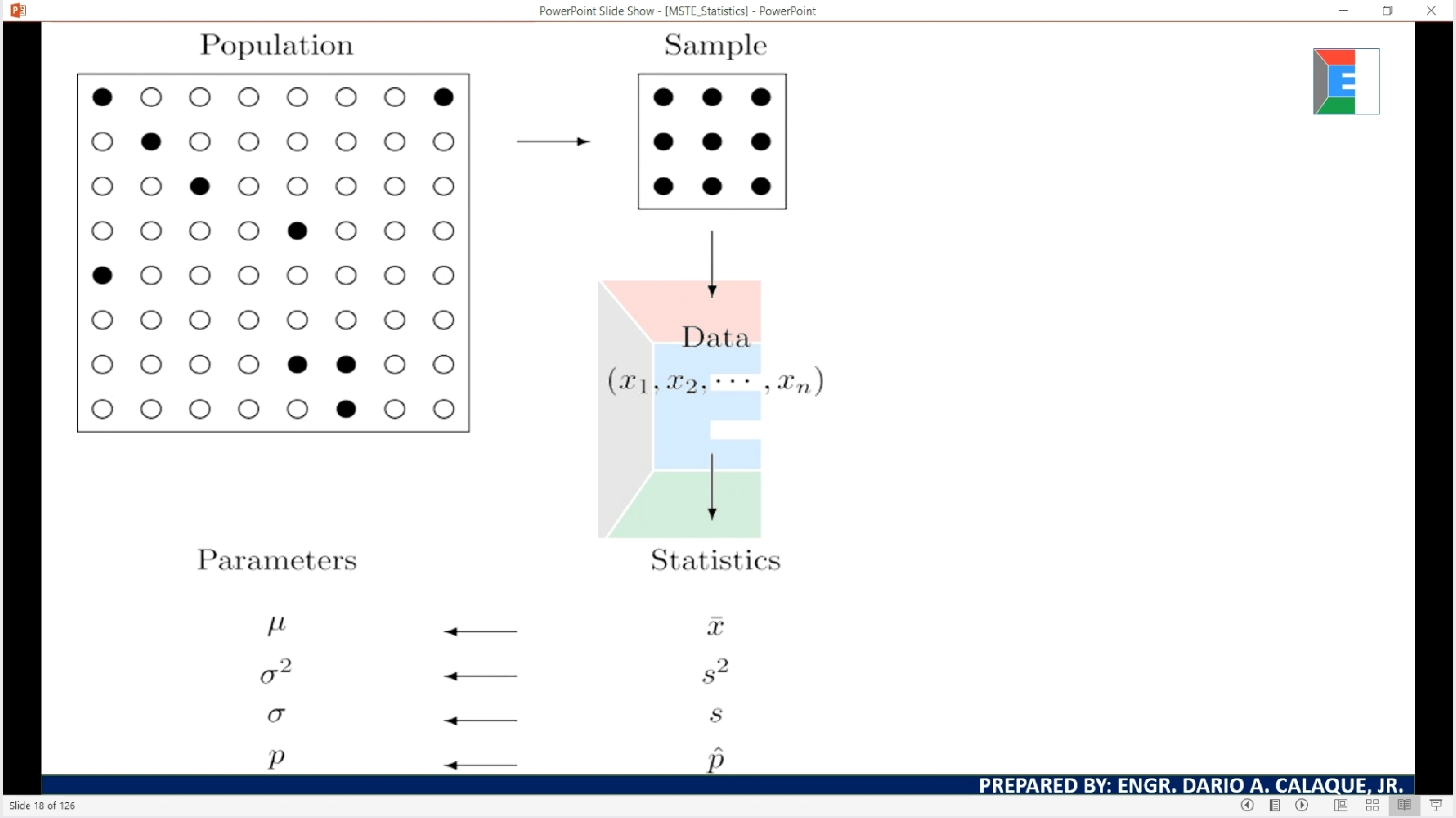
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Population

Sample

Data

$(x_1, x_2, \cdots, x_n)$

Parameters

Statistics

$\mu \longleftarrow \bar{x}$

$\sigma^2 \longleftarrow s^2$

$\sigma \longleftarrow s$

$p \longleftarrow \hat{p}$

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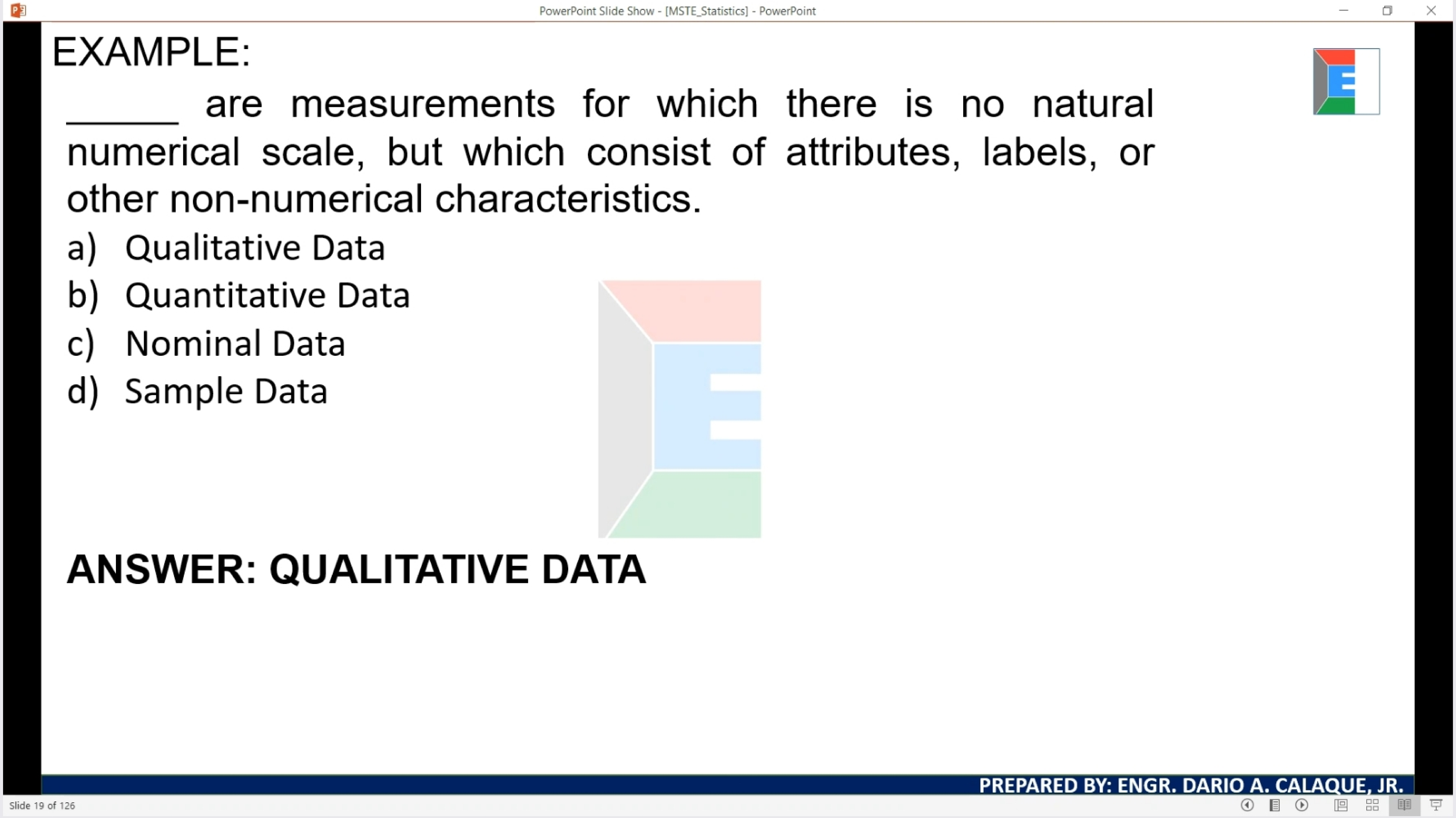
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EXAMPLE:

______ are measurements for which there is no natural numerical scale, but which consist of attributes, labels, or other non-numerical characteristics.

a) Qualitative Data
b) Quantitative Data
c) Nominal Data
d) Sample Data

ANSWER: QUALITATIVE DATA

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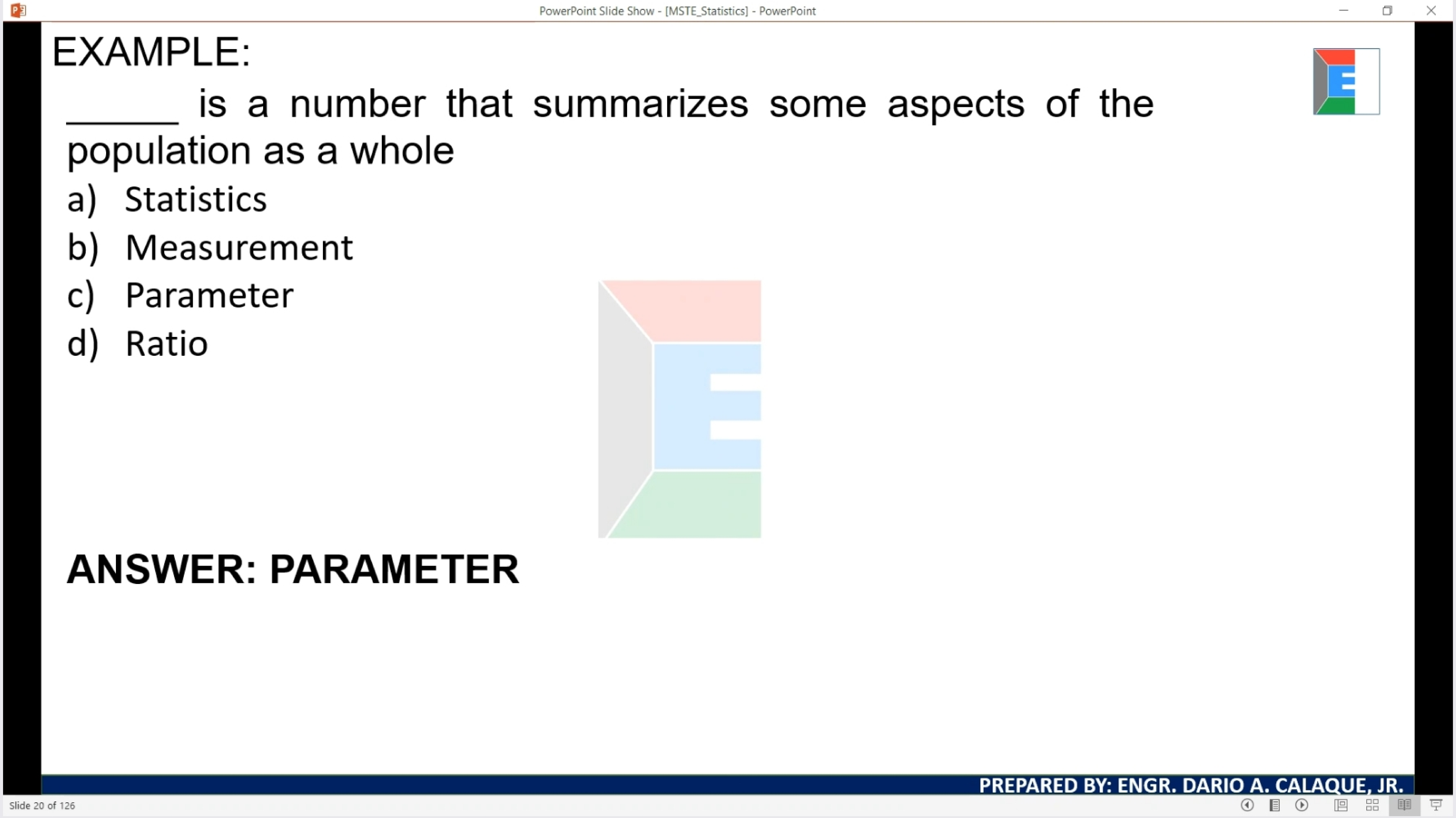
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EXAMPLE:

______ is a number that summarizes some aspects of the population as a whole

a) Statistics
b) Measurement
c) Parameter
d) Ratio

ANSWER: PARAMETER

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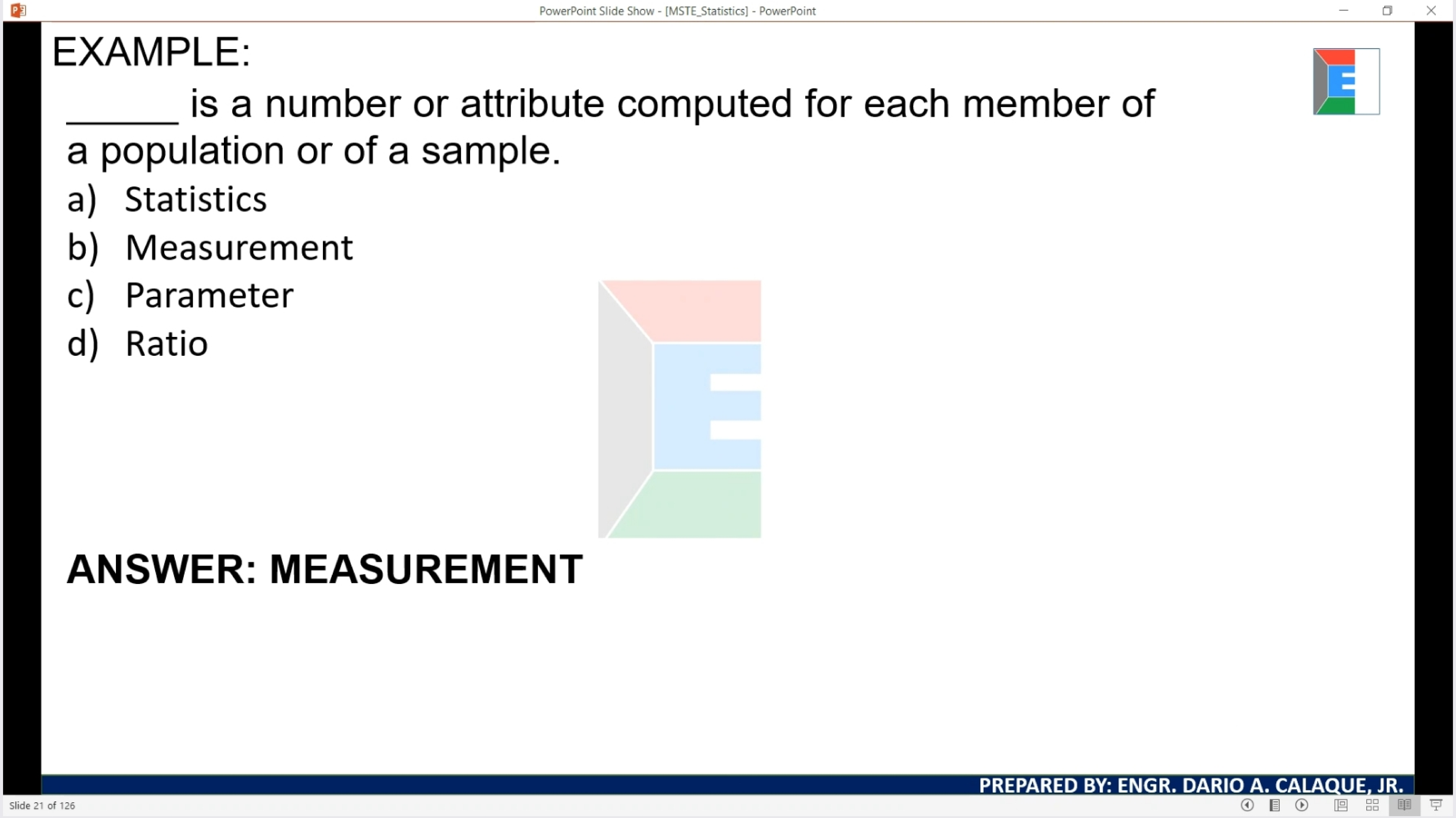
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Slide 21 of 126

EXAMPLE:

______ is a number or attribute computed for each member of a population or of a sample.

a) Statistics
b) Measurement
c) Parameter
d) Ratio

ANSWER: MEASUREMENT

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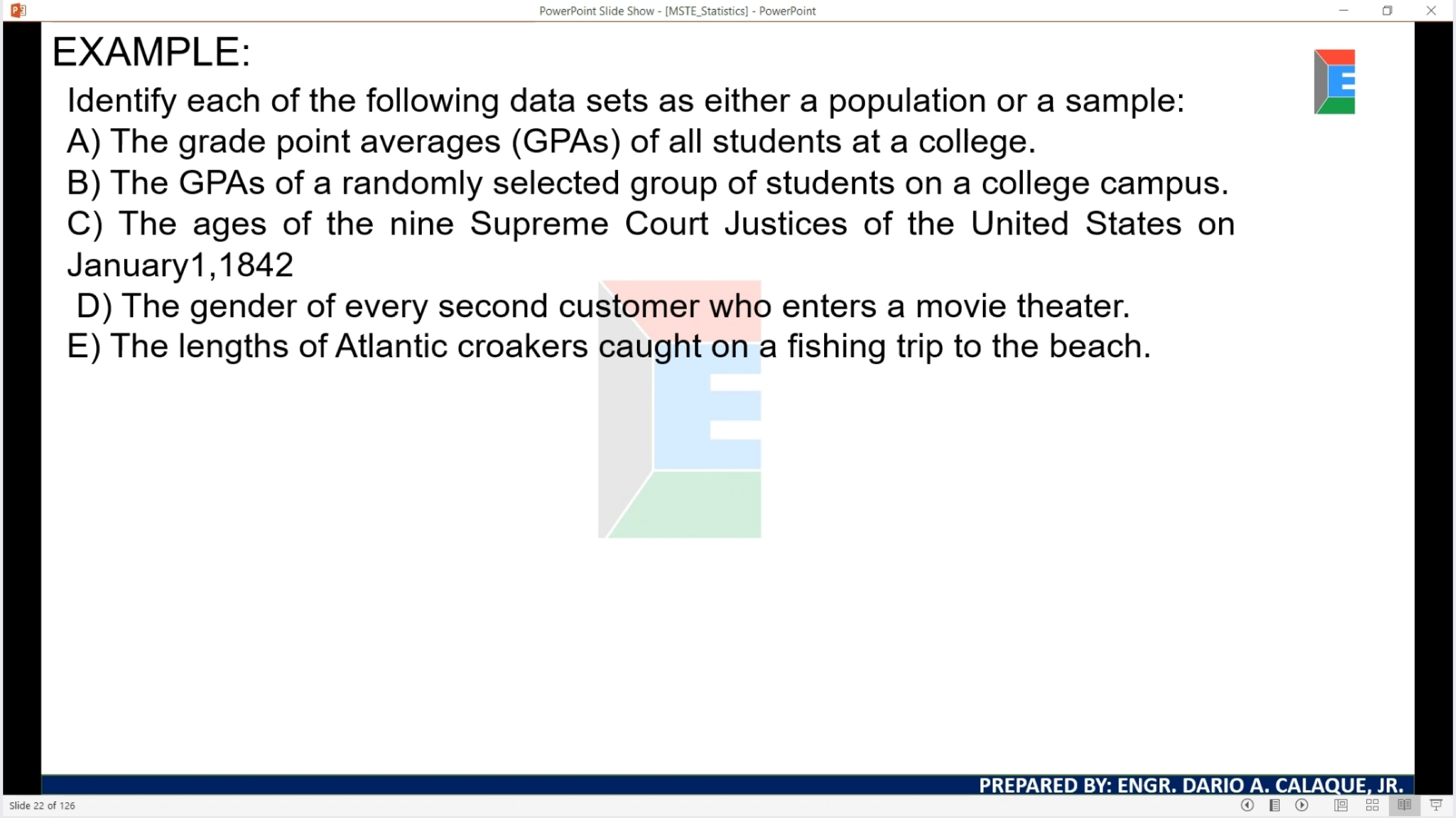
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EXAMPLE:

Identify each of the following data sets as either a population or a sample:

A) The grade point averages (GPAs) of all students at a college.

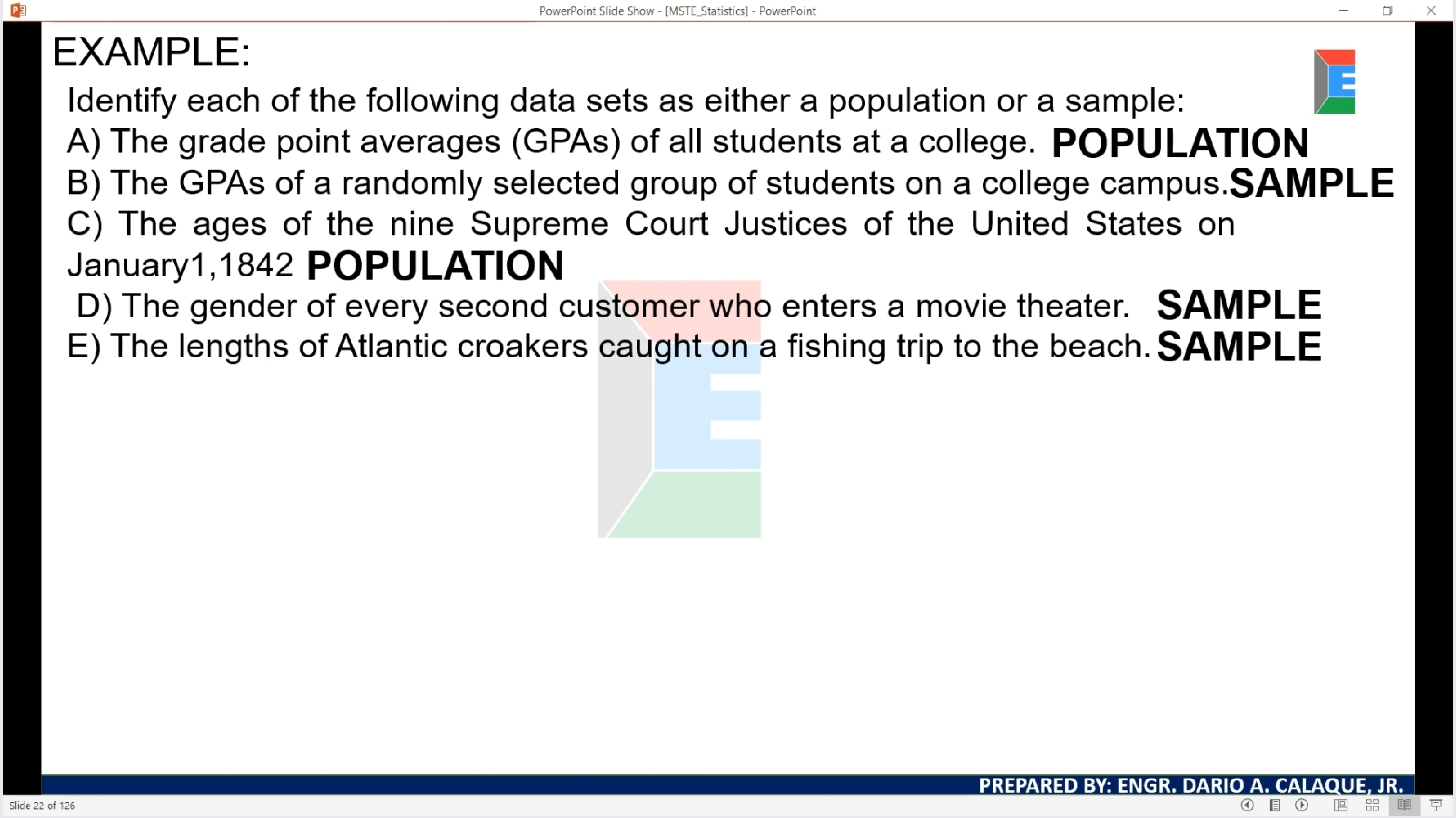
B) The GPAs of a randomly selected group of students on a college campus.

C) The ages of the nine Supreme Court Justices of the United States on January1,1842

D) The gender of every second customer who enters a movie theater.

E) The lengths of Atlantic croakers caught on a fishing trip to the beach.

Slide 22 of 126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Slide 22 of 126

EXAMPLE:

Identify each of the following data sets as either a population or a sample:

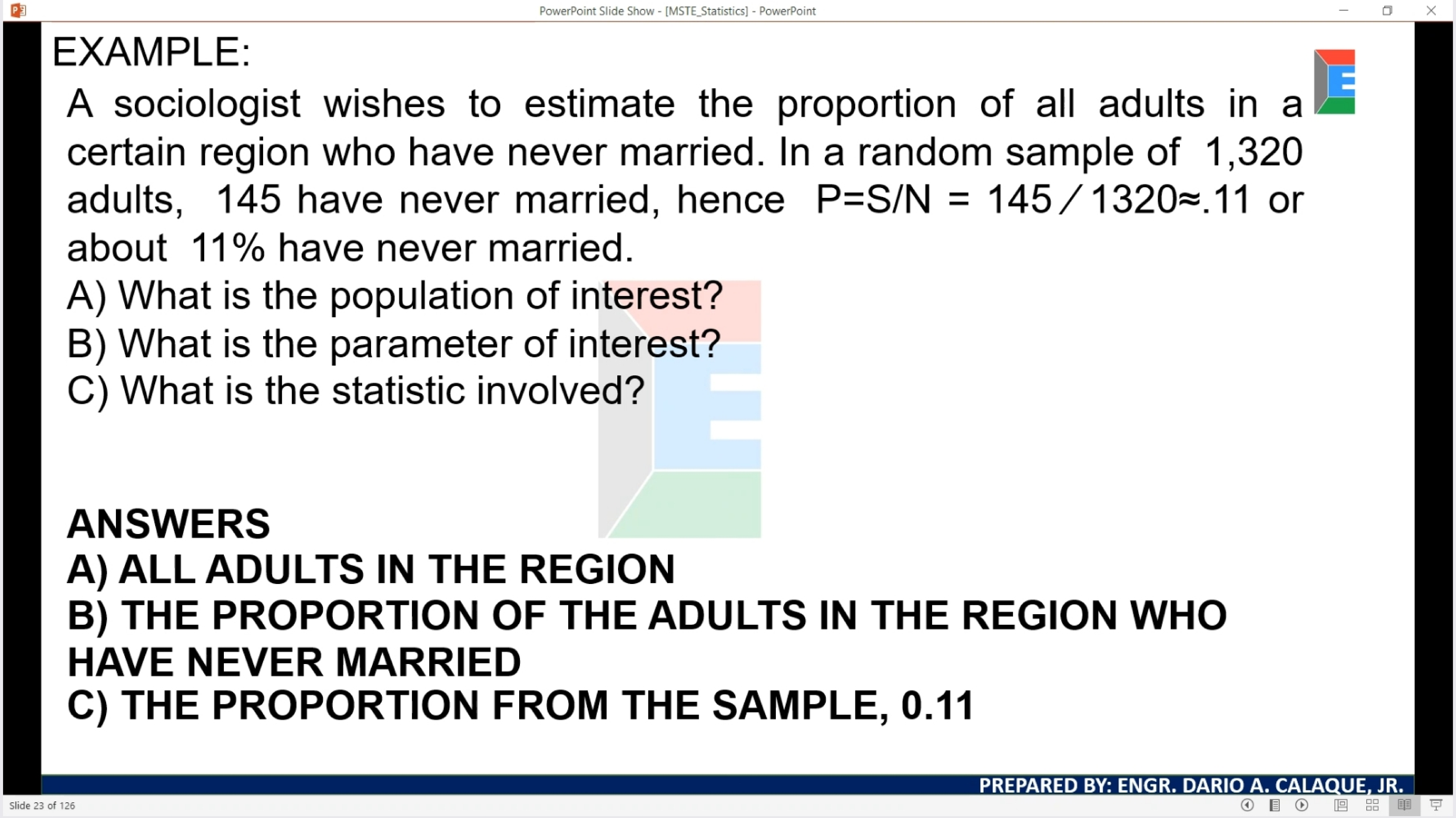
A) The grade point averages (GPAs) of all students at a college. **POPULATION**

B) The GPAs of a randomly selected group of students on a college campus.**SAMPLE**

C) The ages of the nine Supreme Court Justices of the United States on January1,1842 **POPULATION**

D) The gender of every second customer who enters a movie theater. **SAMPLE**

E) The lengths of Atlantic croakers caught on a fishing trip to the beach. **SAMPLE**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EXAMPLE:

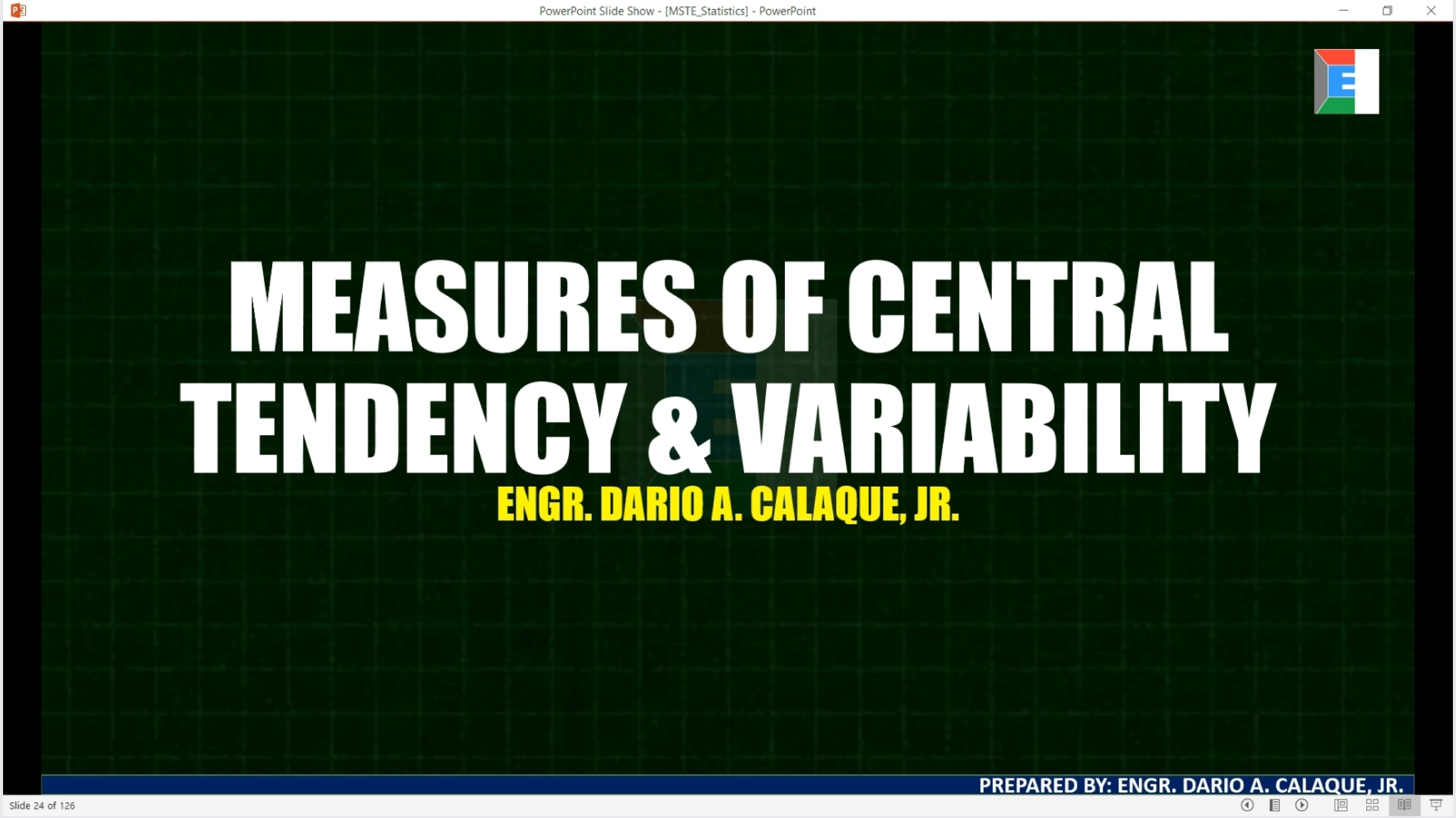
A sociologist wishes to estimate the proportion of all adults in a certain region who have never married. In a random sample of 1,320 adults, 145 have never married, hence $P=S/N = 145/1320 \approx .11$ or about 11% have never married.

A) What is the population of interest?
B) What is the parameter of interest?
C) What is the statistic involved?

ANSWERS

A) ALL ADULTS IN THE REGION
B) THE PROPORTION OF THE ADULTS IN THE REGION WHO HAVE NEVER MARRIED
C) THE PROPORTION FROM THE SAMPLE, 0.11

Slide 23 of 126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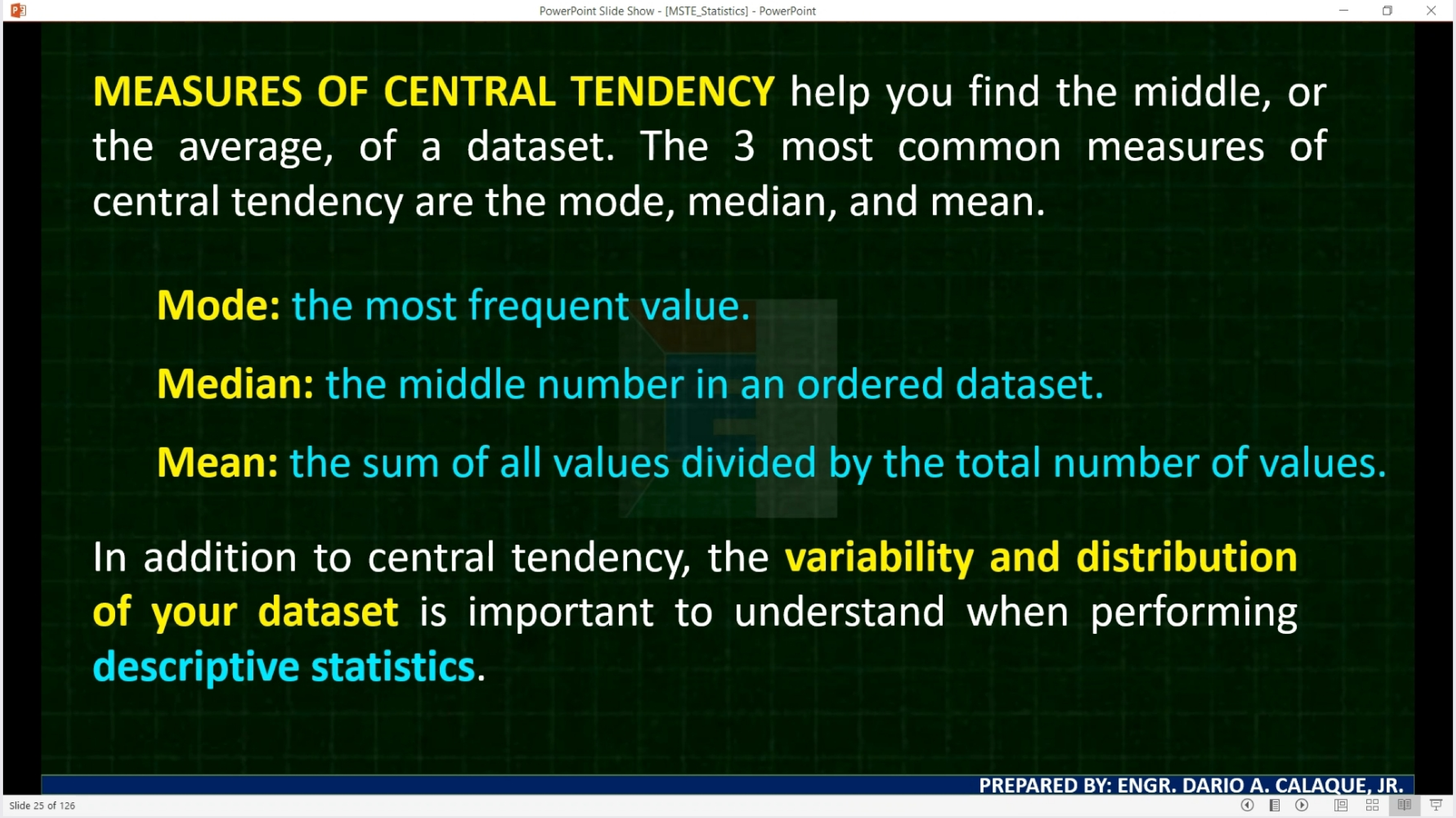
Slide 24 of 126

MEASURES OF CENTRAL TENDENCY & VARIABILITY

ENGR. DARIO A. CALAQUE, JR.

PREPARED BY: ENGR. DARIO A. CALAQUE, JR.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Slide 25 of 126

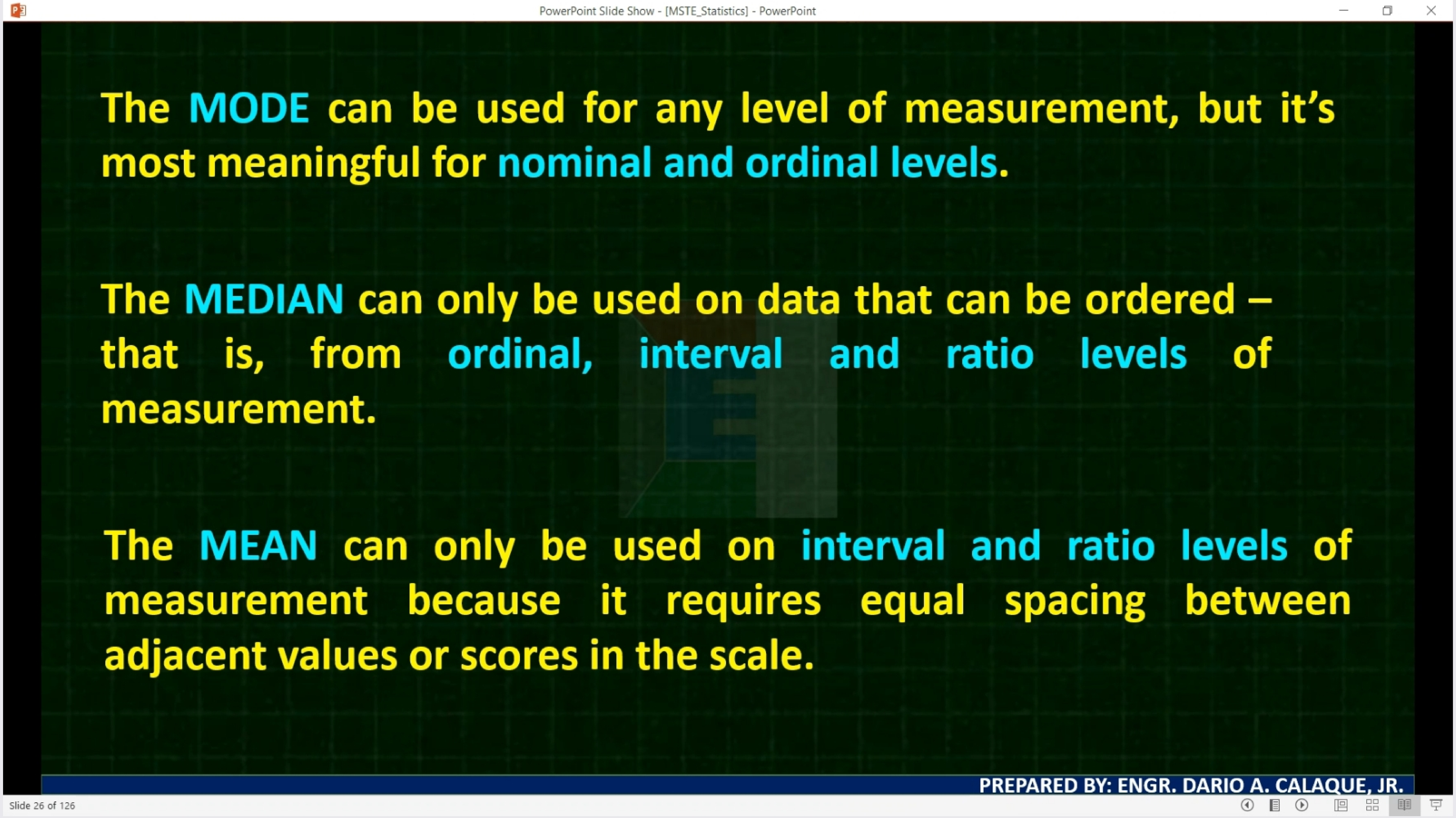
MEASURES OF CENTRAL TENDENCY help you find the middle, or the average, of a dataset. The 3 most common measures of central tendency are the mode, median, and mean.

Mode: the most frequent value.

Median: the middle number in an ordered dataset.

Mean: the sum of all values divided by the total number of values.

In addition to central tendency, the **variability and distribution of your dataset** is important to understand when performing **descriptive statistics**.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Slide 26 of 126

The **MODE** can be used for any level of measurement, but it's most meaningful for **nominal and ordinal levels**.

The **MEDIAN** can only be used on data that can be ordered – that is, from **ordinal, interval and ratio levels** of measurement.

The **MEAN** can only be used on **interval and ratio levels** of measurement because it requires equal spacing between adjacent values or scores in the scale.

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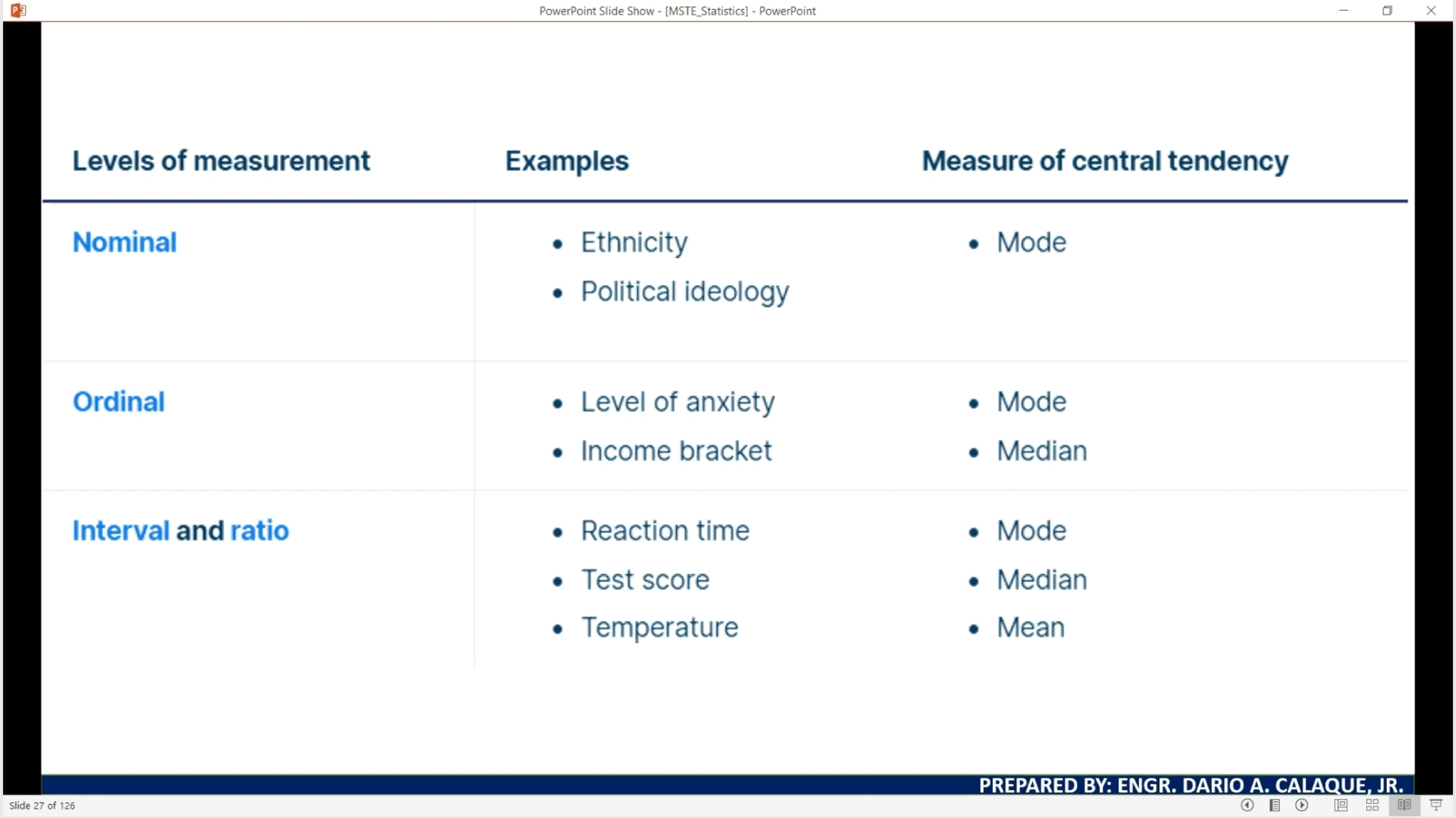
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Slide 27 of 126

Levels of measurement	Examples	Measure of central tendency
Nominal	• Ethnicity • Political ideology	• Mode
Ordinal	• Level of anxiety • Income bracket	• Mode • Median
Interval and ratio	• Reaction time • Test score • Temperature	• Mode • Median • Mean

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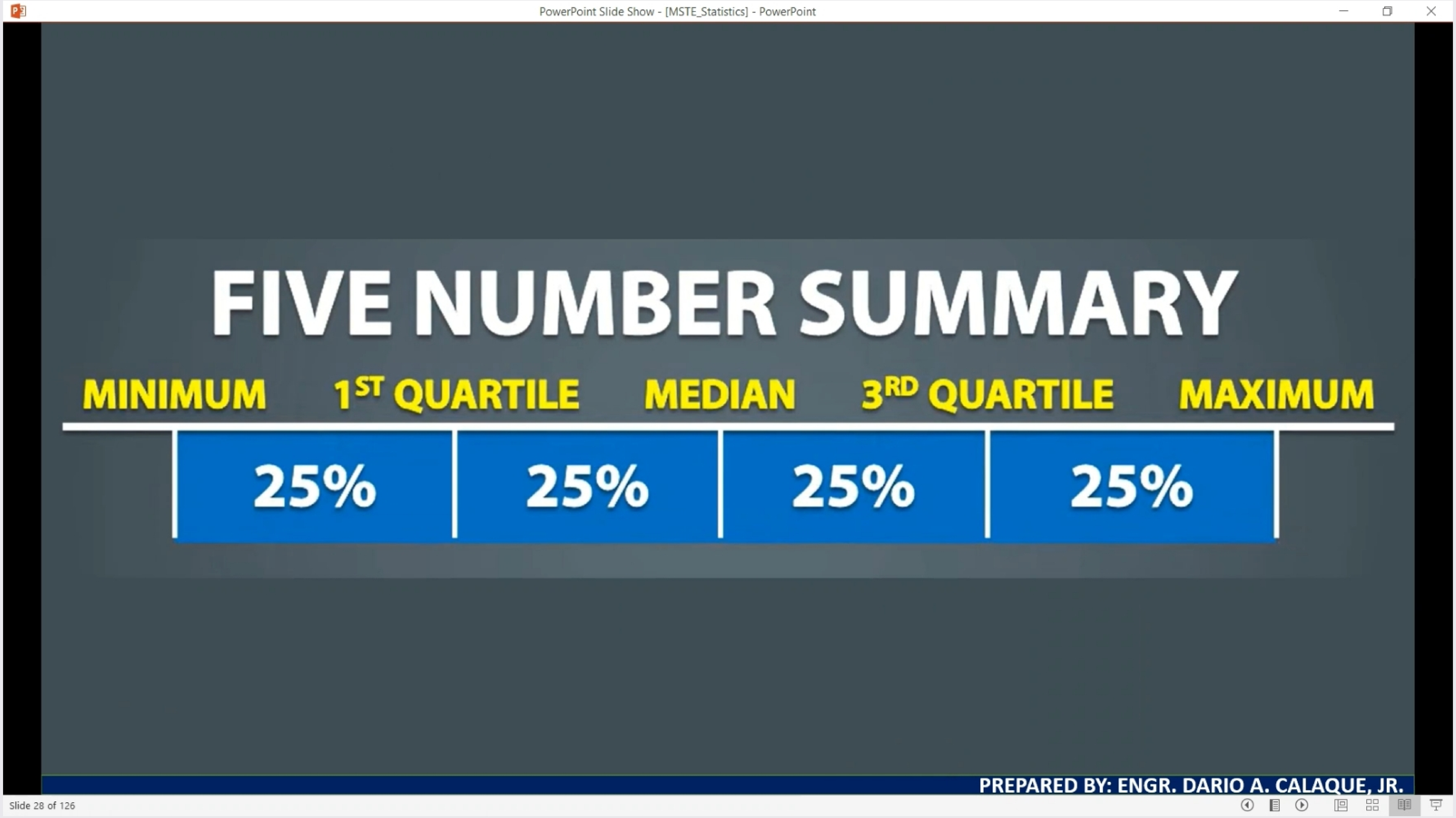
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Slide 28 of 126

FIVE NUMBER SUMMARY

MINIMUM
1ST QUARTILE
MEDIAN
3RD QUARTILE
MAXIMUM

25%
25%
25%
25%

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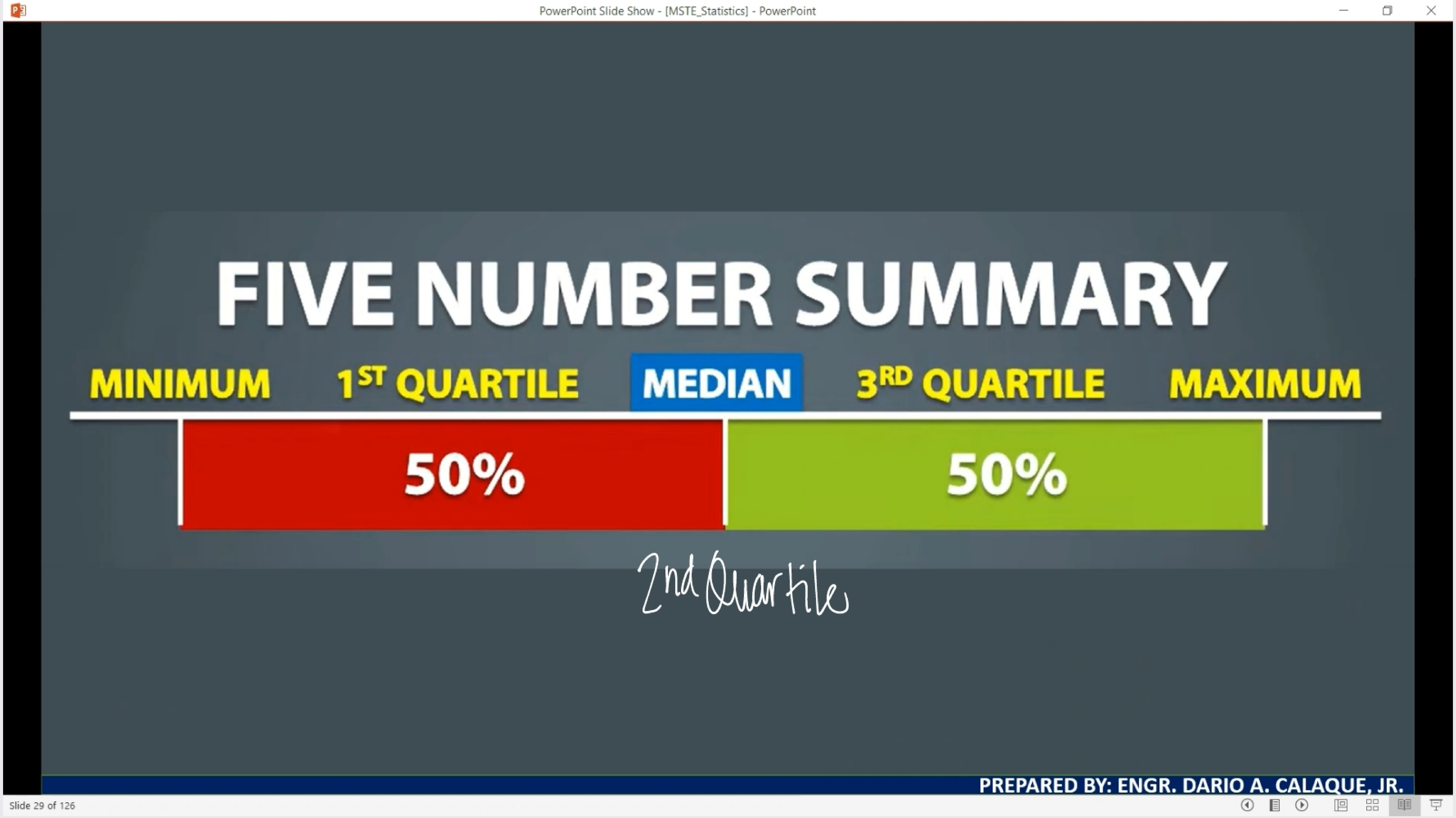
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Slide 29 of 126

FIVE NUMBER SUMMARY

MINIMUM

1^{ST} QUARTILE

MEDIAN

3^{RD} QUARTILE

MAXIMUM

50%

50%

2nd Quartile

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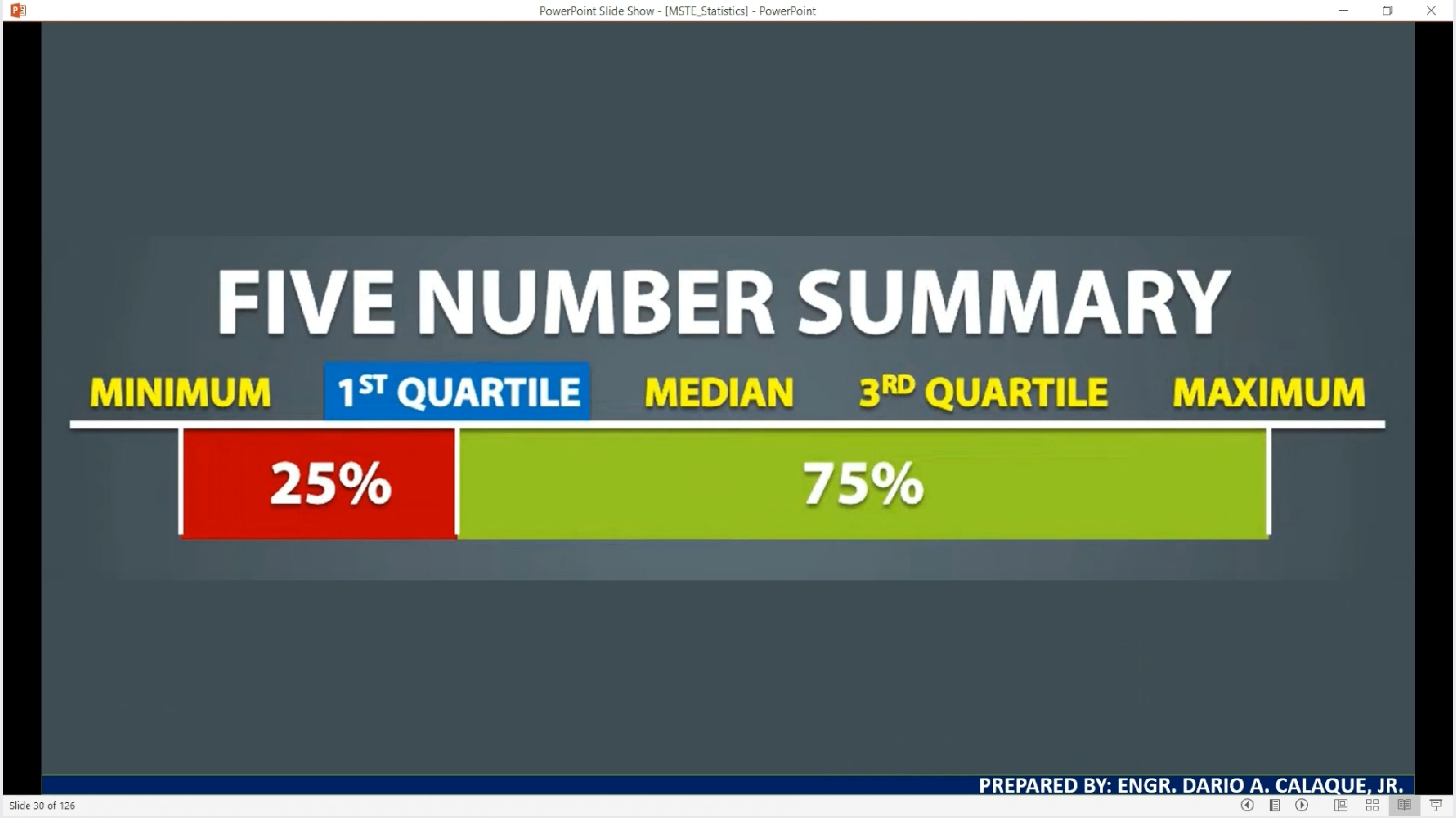
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Slide 30 of 126

FIVE NUMBER SUMMARY

MINIMUM
1ST QUARTILE
MEDIAN
3RD QUARTILE
MAXIMUM

25%
75%

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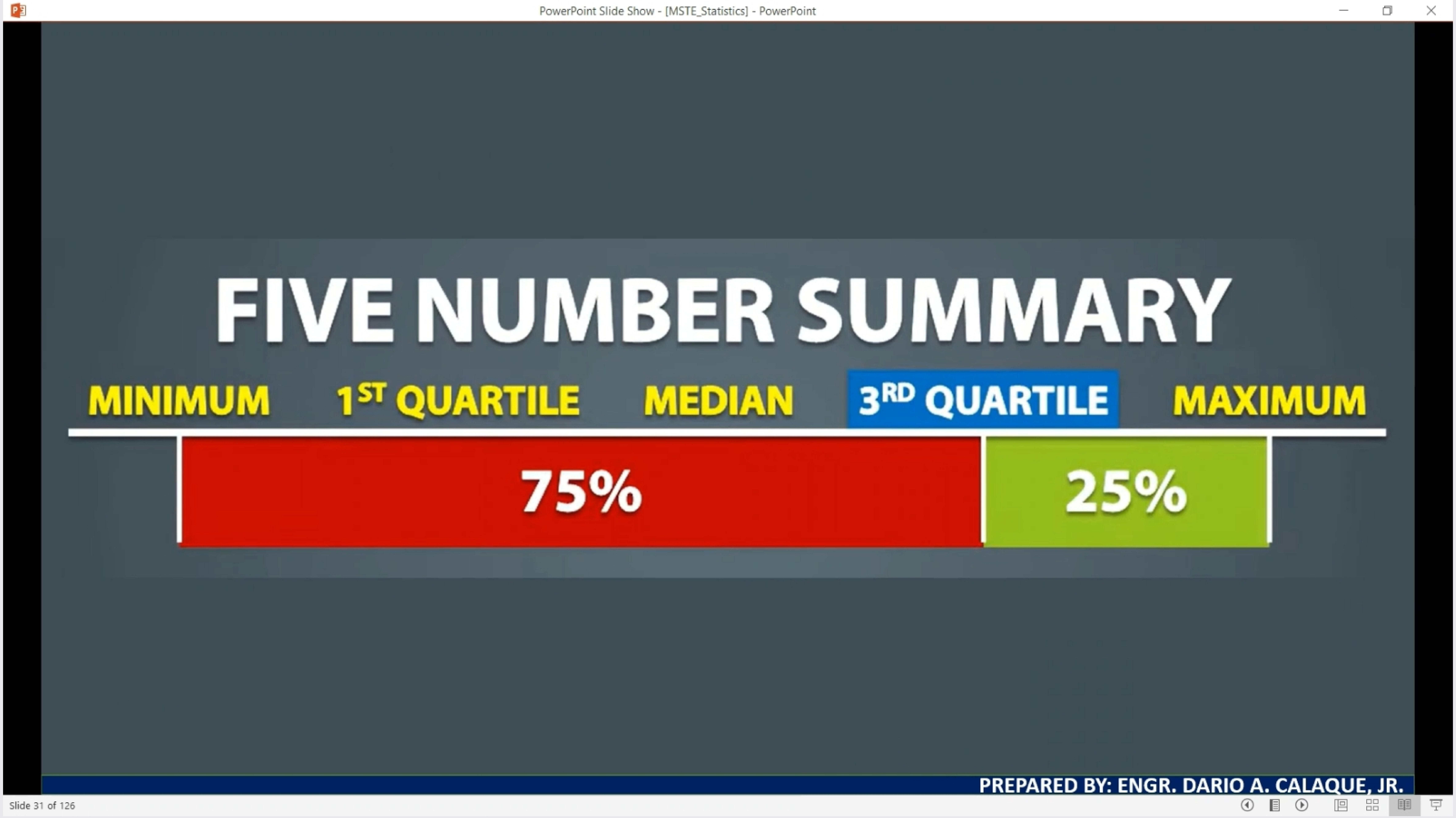
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FIVE NUMBER SUMMARY

MINIMUM | 1ST QUARTILE | MEDIAN | 3RD QUARTILE | MAXIMUM

75% | 25%

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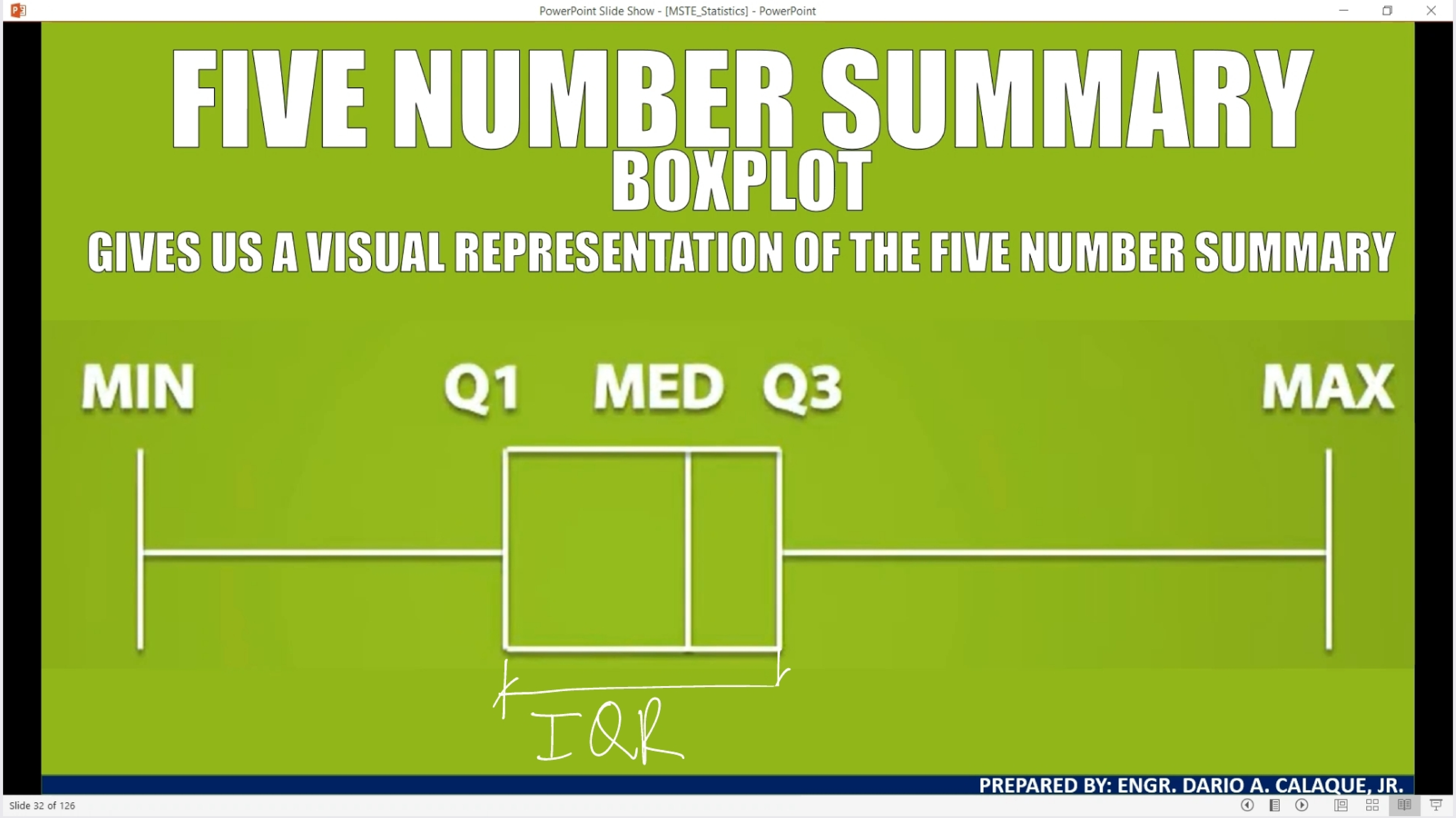
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MIN
Q1
MED
Q3
MAX
IQR
Slide 32 of 126

FIVE NUMBER SUMMARY

BOXPLOT

GIVES US A VISUAL REPRESENTATION OF THE FIVE NUMBER SUMMARY

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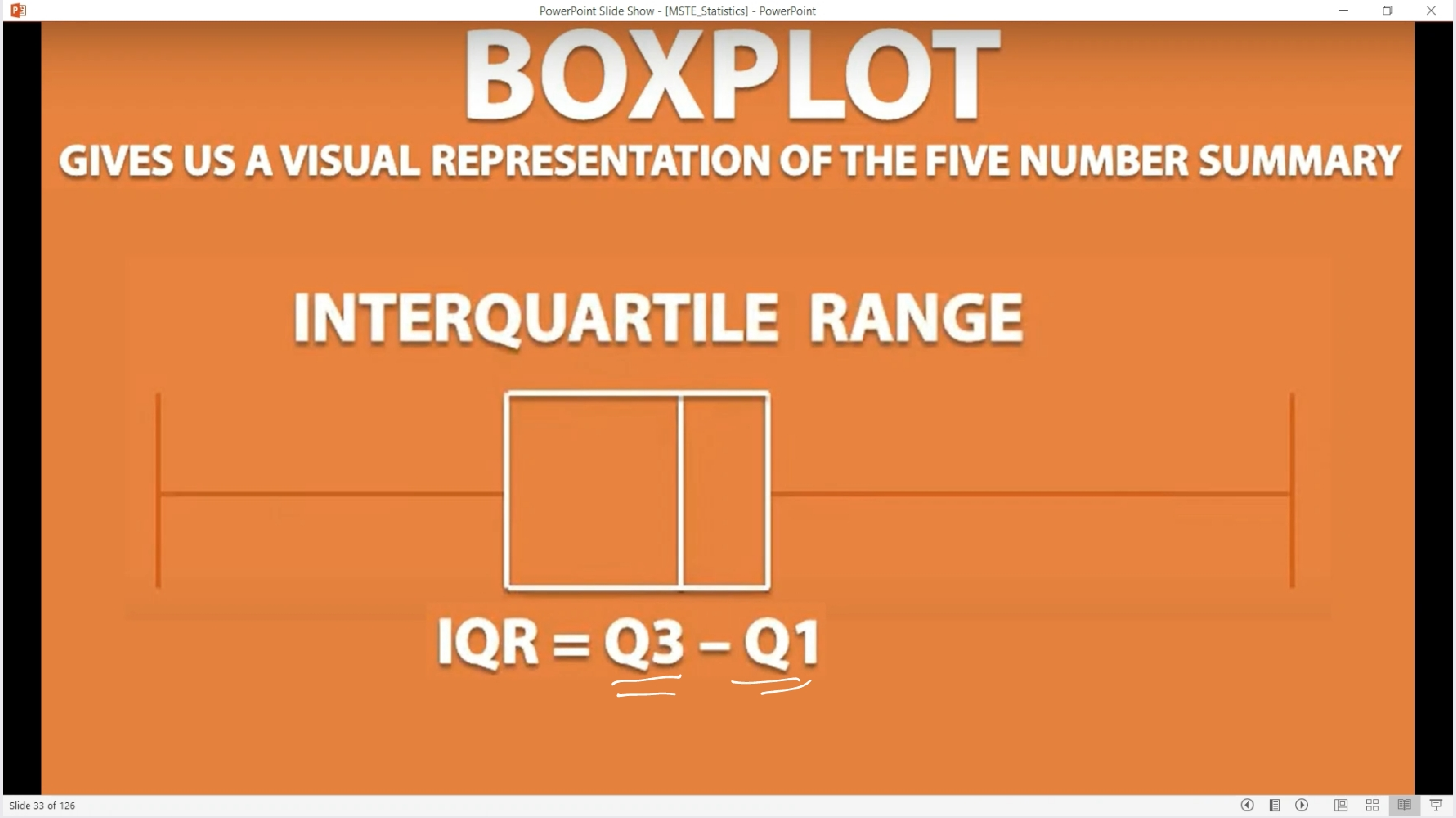
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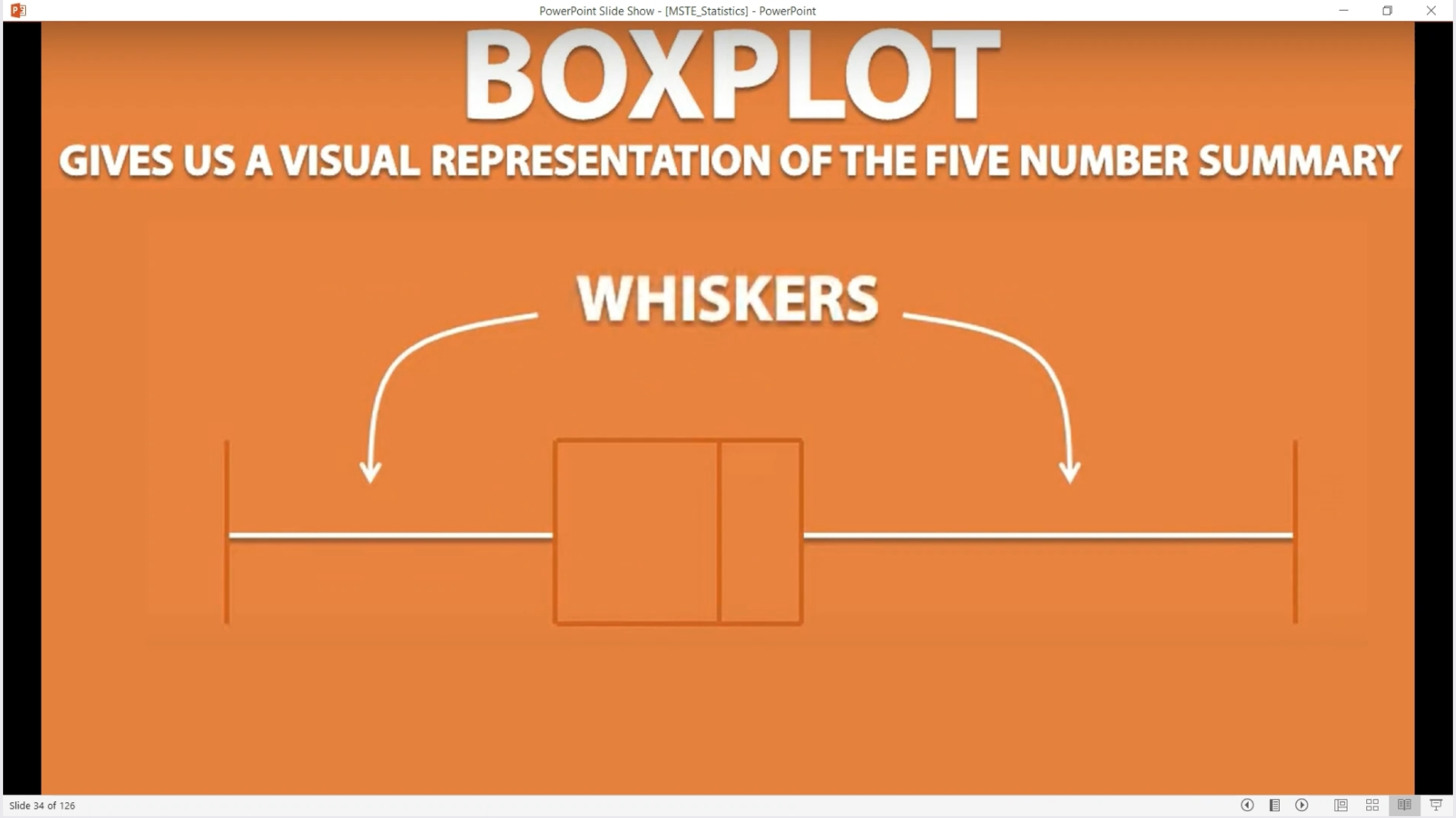
Slide 33 of 126

BOXPLOT

GIVES US A VISUAL REPRESENTATION OF THE FIVE NUMBER SUMMARY

INTERQUARTILE RANGE

$$IQR = \underline{Q3} - \underline{Q1}$$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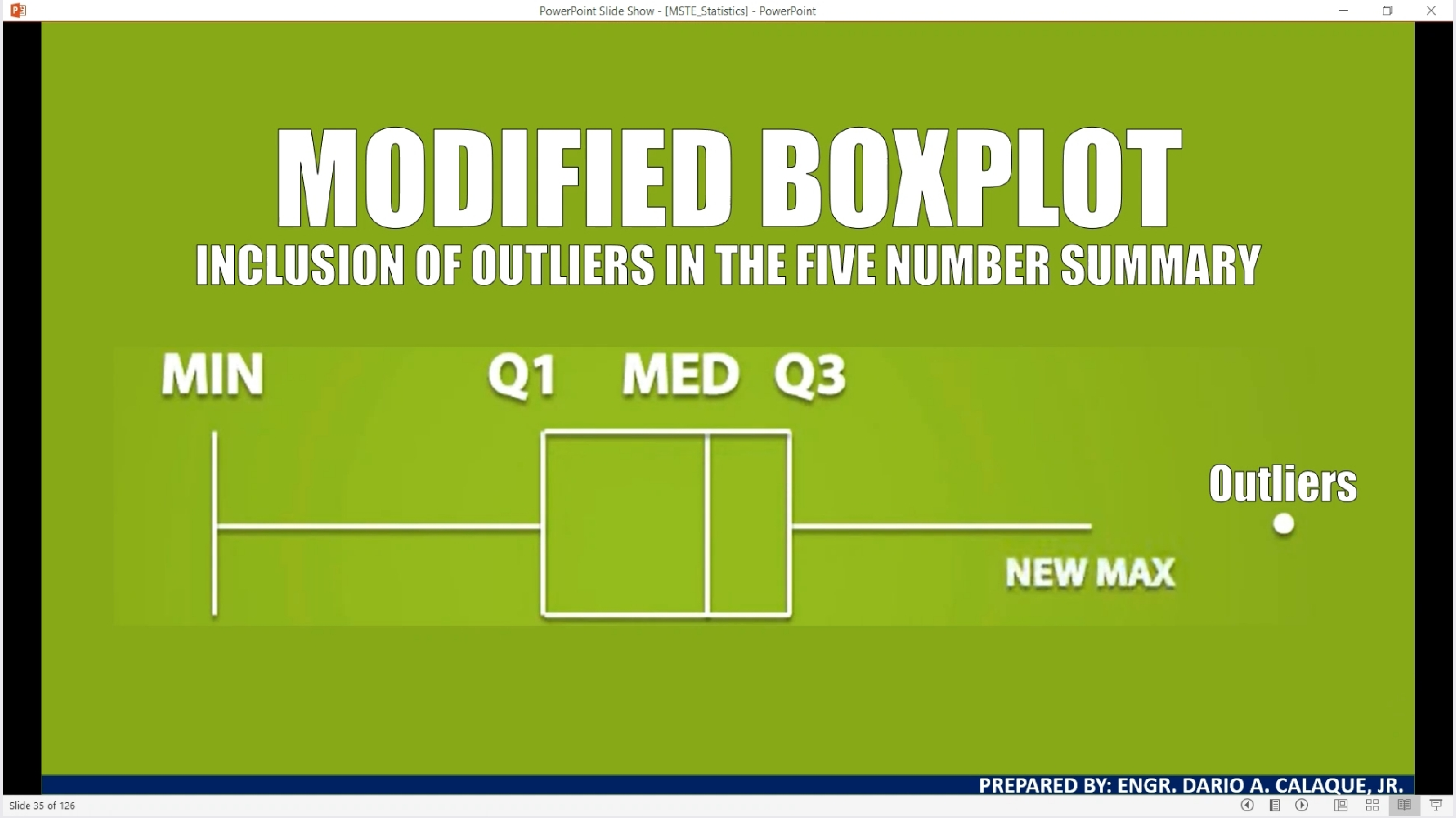
BOXPLOT

GIVES US A VISUAL REPRESENTATION OF THE FIVE NUMBER SUMMARY

WHISKERS

Slide 34 of 126



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MODIFIED BOXPLOT

INCLUSION OF OUTLIERS IN THE FIVE NUMBER SUMMARY

MIN
Q1
MED
Q3
Outliers
NEW MAX

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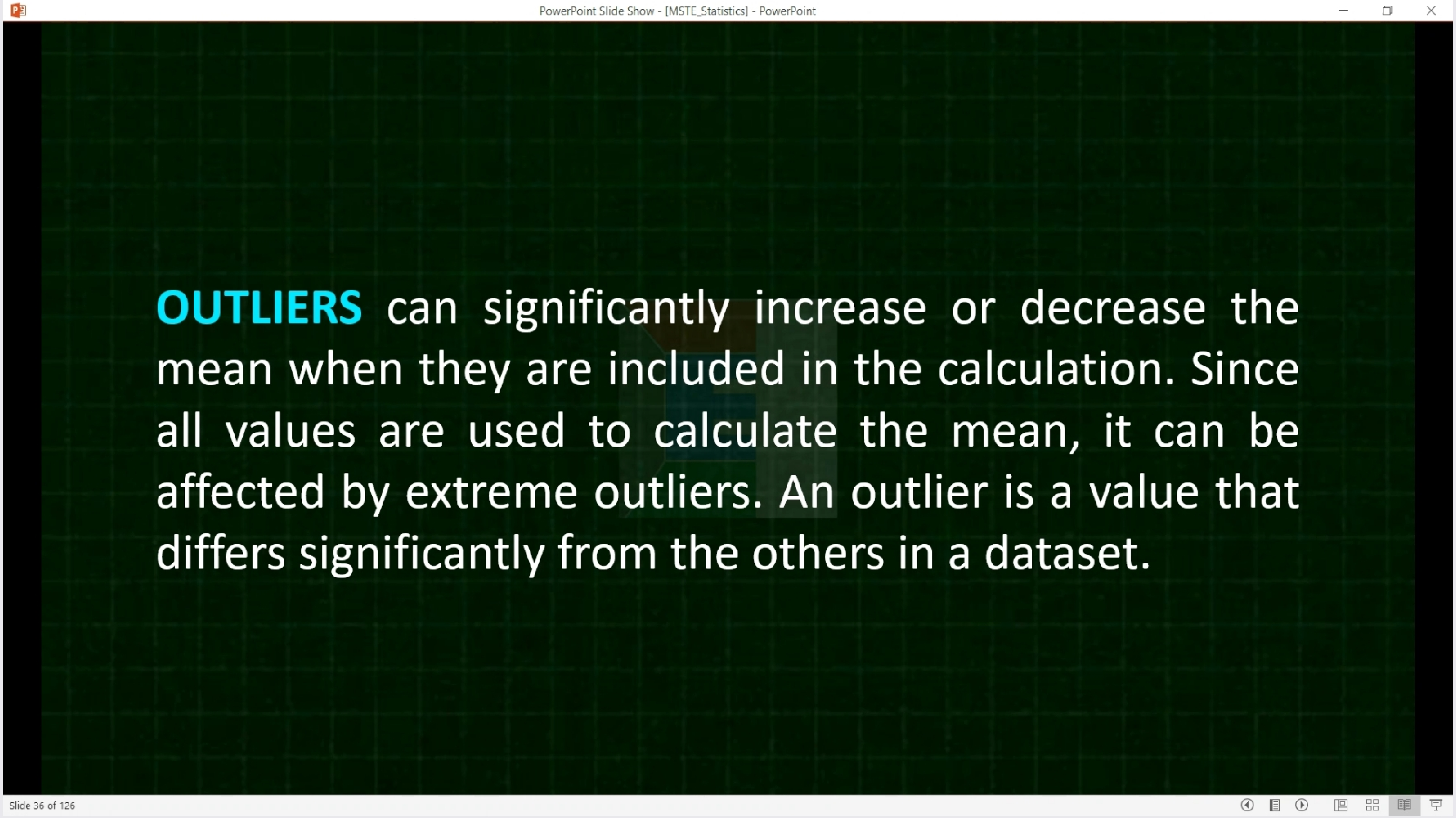
Slide 35 of 126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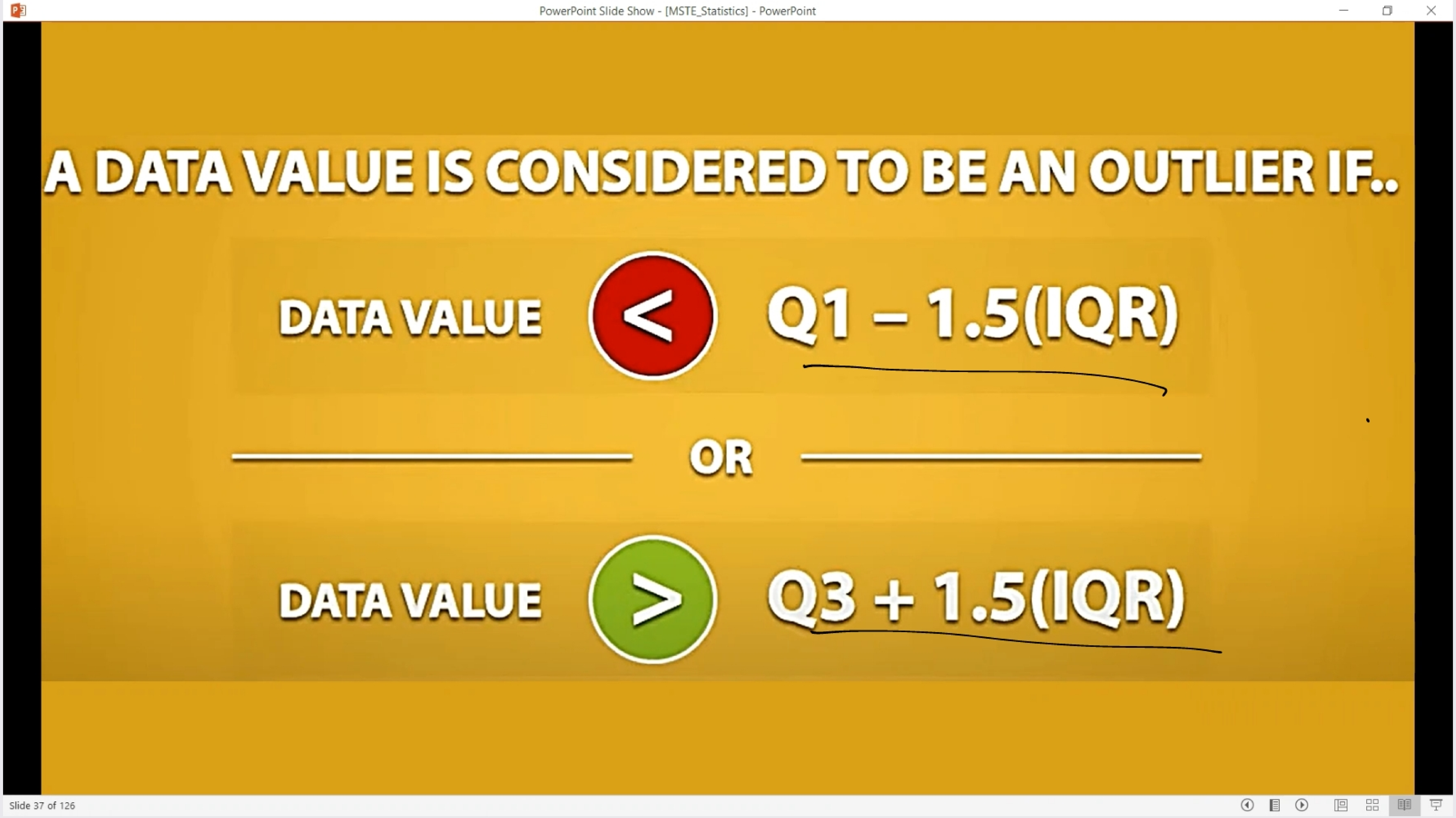
Slide 36 of 126

OUTLIERS can significantly increase or decrease the mean when they are included in the calculation. Since all values are used to calculate the mean, it can be affected by extreme outliers. An outlier is a value that differs significantly from the others in a dataset.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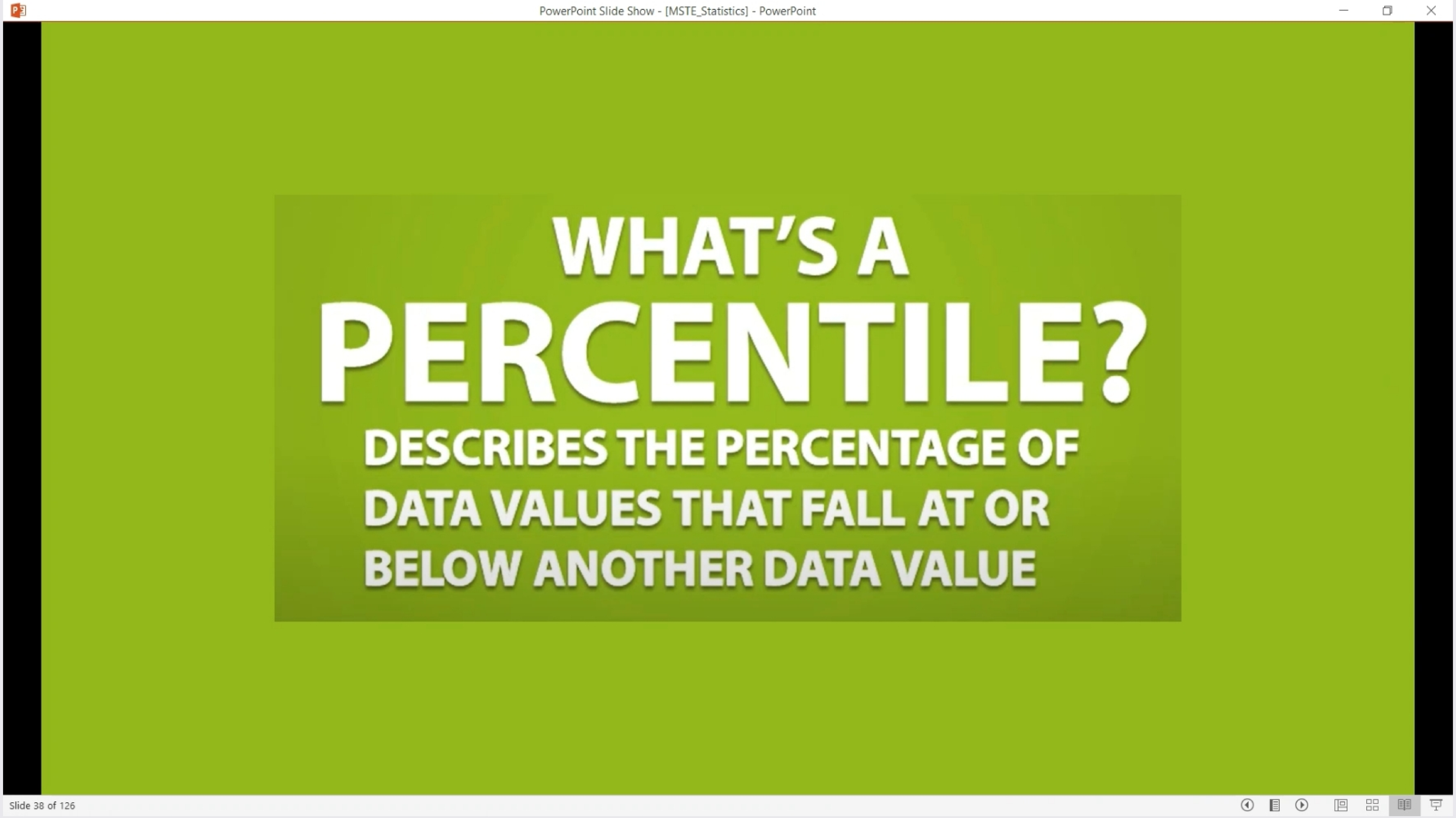
Slide 37 of 126

A DATA VALUE IS CONSIDERED TO BE AN OUTLIER IF..

DATA VALUE $<$ $Q1 - 1.5(IQR)$

OR

DATA VALUE $>$ $Q3 + 1.5(IQR)$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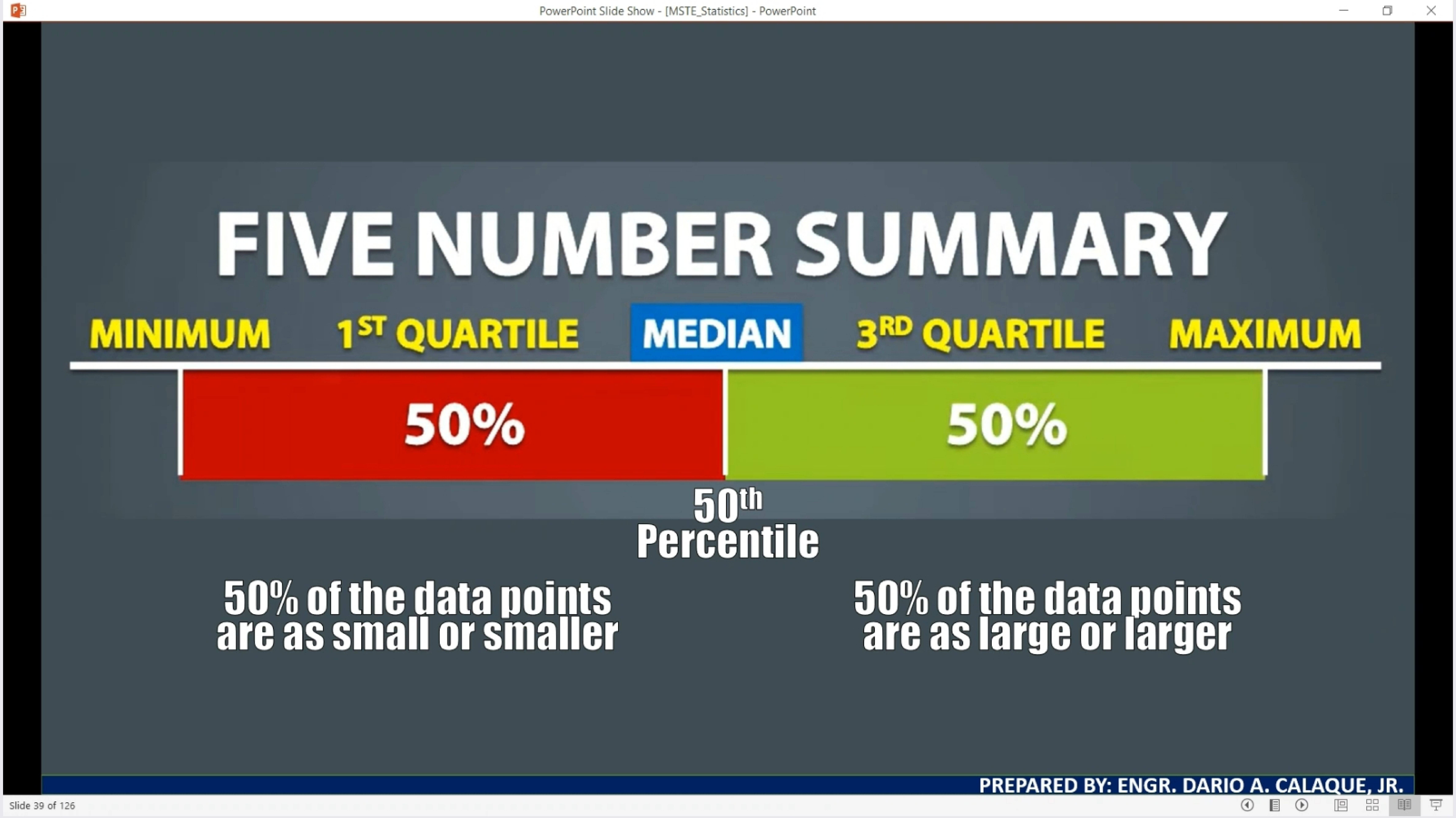
Slide 38 of 126

WHAT'S A PERCENTILE?

DESCRIBES THE PERCENTAGE OF DATA VALUES THAT FALL AT OR BELOW ANOTHER DATA VALUE



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FIVE NUMBER SUMMARY

MINIMUM

1ST QUARTILE

MEDIAN

3RD QUARTILE

MAXIMUM

50th
Percentile

50% of the data points
are as small or smaller

50% of the data points
are as large or larger

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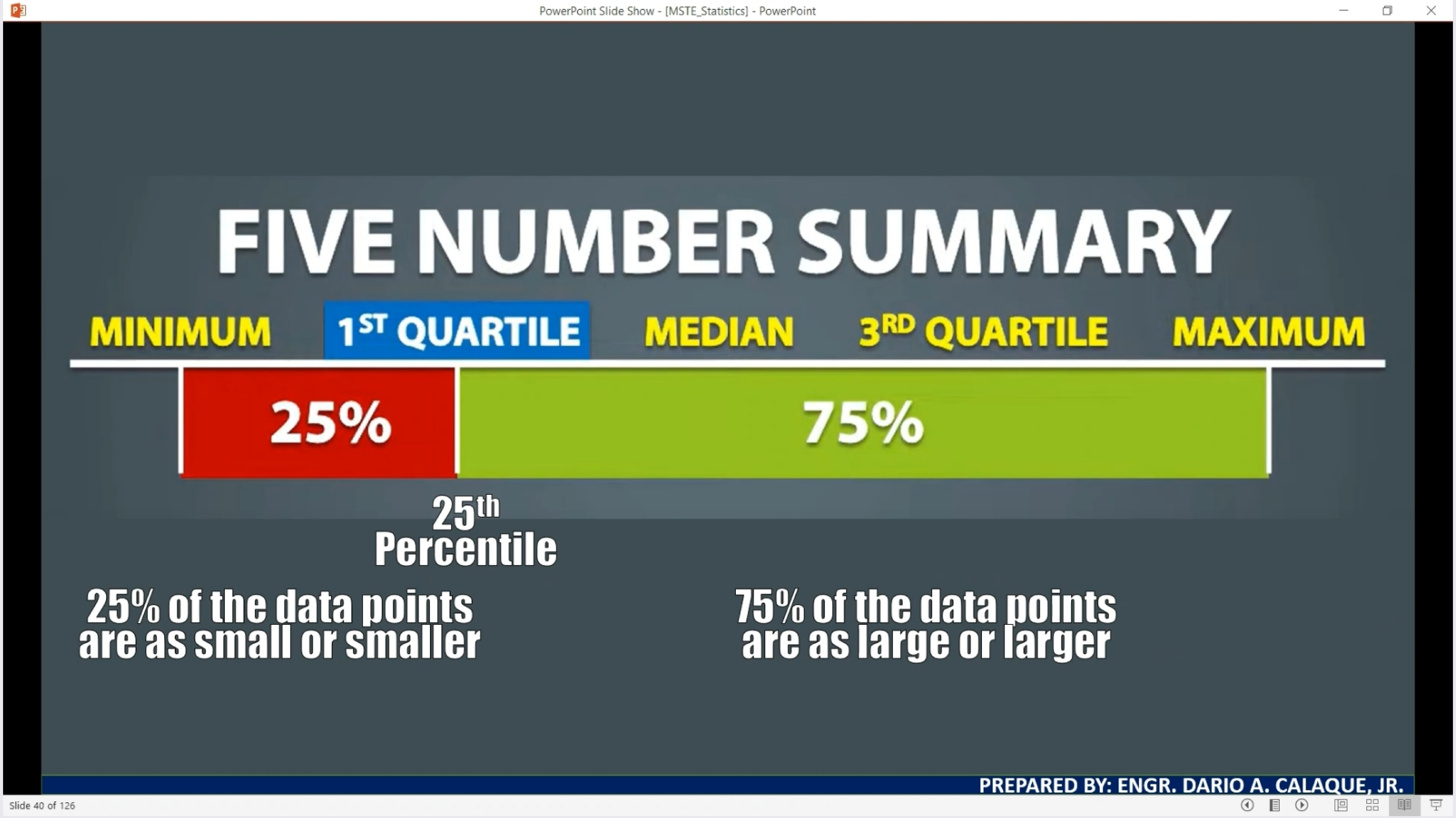

PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
Slide 40 of 126

FIVE NUMBER SUMMARY

MINIMUM
1ST QUARTILE
MEDIAN
3RD QUARTILE
MAXIMUM

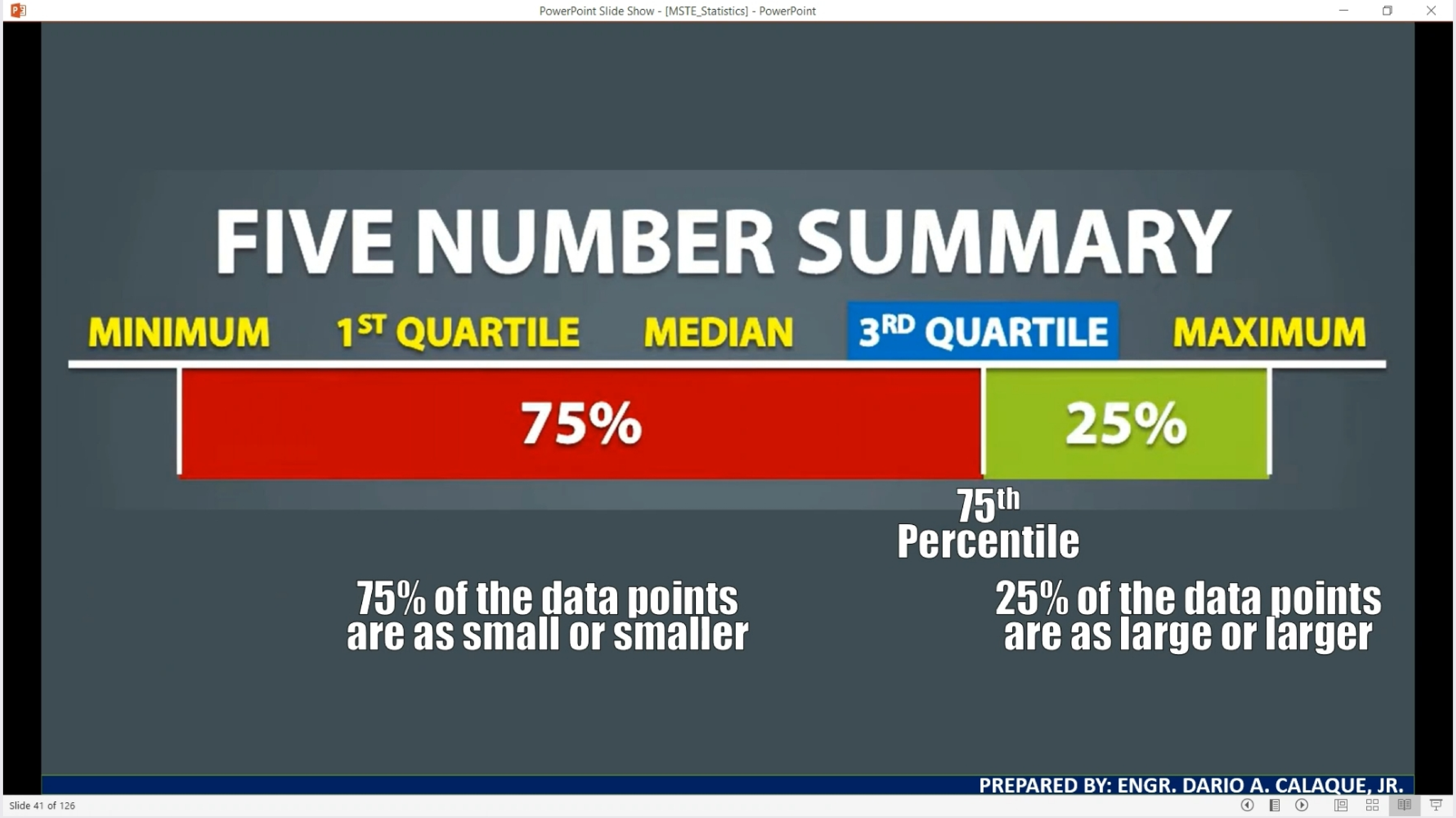
25%
75%

25th
Percentile

25% of the data points
are as small or smaller

75% of the data points
are as large or larger

PREPARED BY: ENGR. DARIO A. CALAQUE, JR.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Slide 41 of 126

FIVE NUMBER SUMMARY

MINIMUM 1ST QUARTILE MEDIAN **3RD QUARTILE** MAXIMUM

75% 25%

75th Percentile

75% of the data points are as small or smaller

25% of the data points are as large or larger

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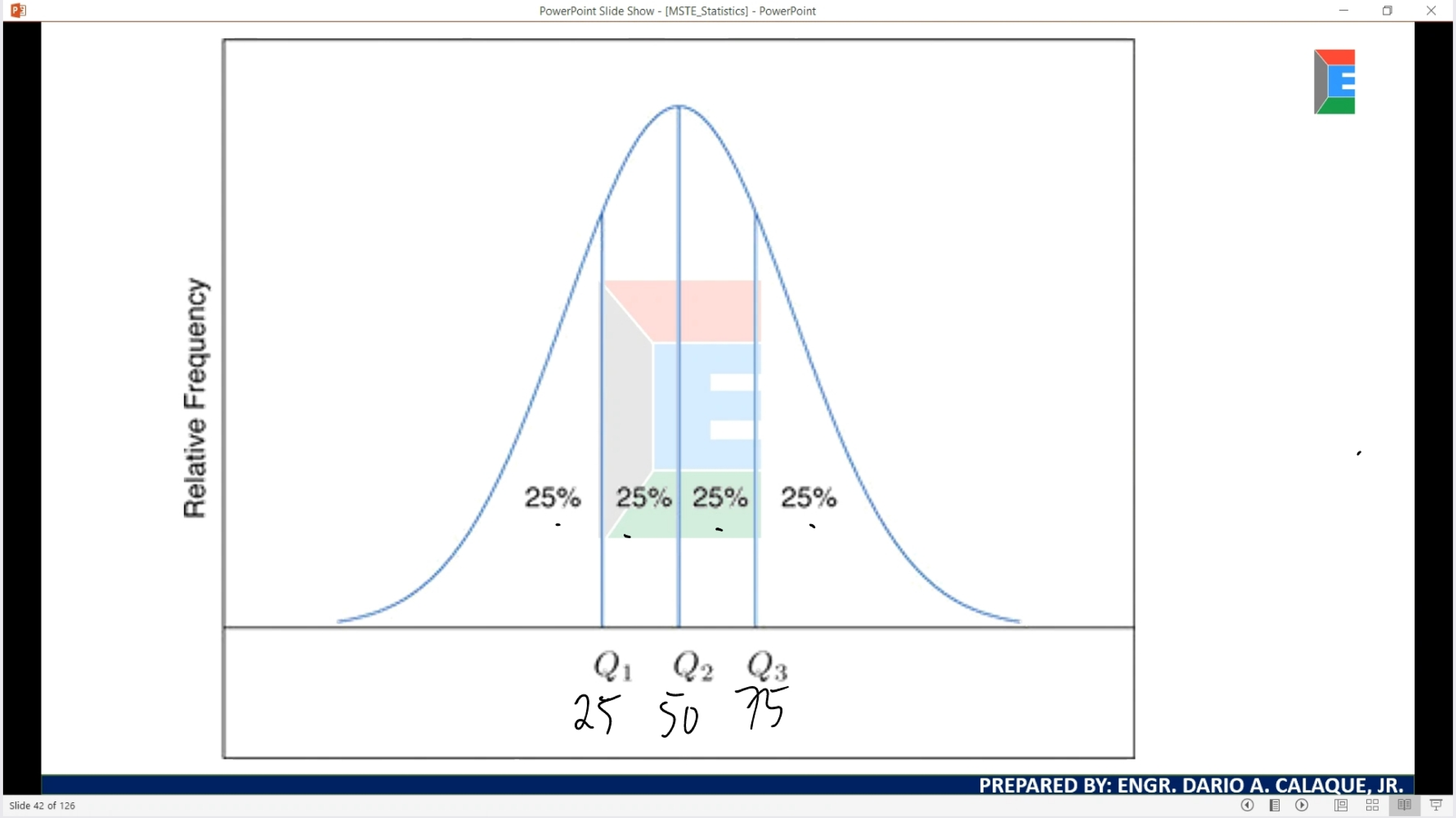
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Relative Frequency
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Q_2
Q_3
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Slide 42 of 126

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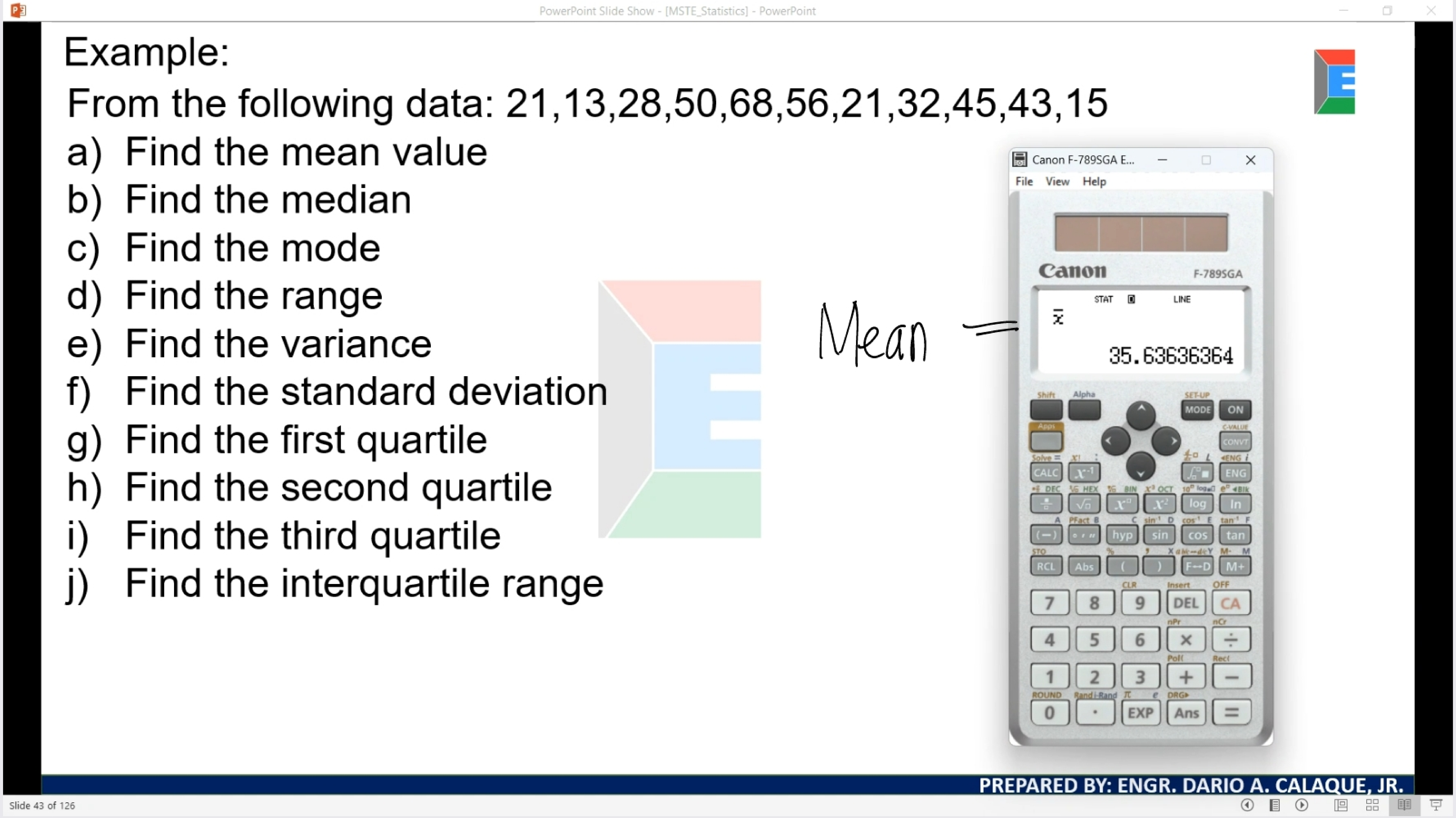
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Example:

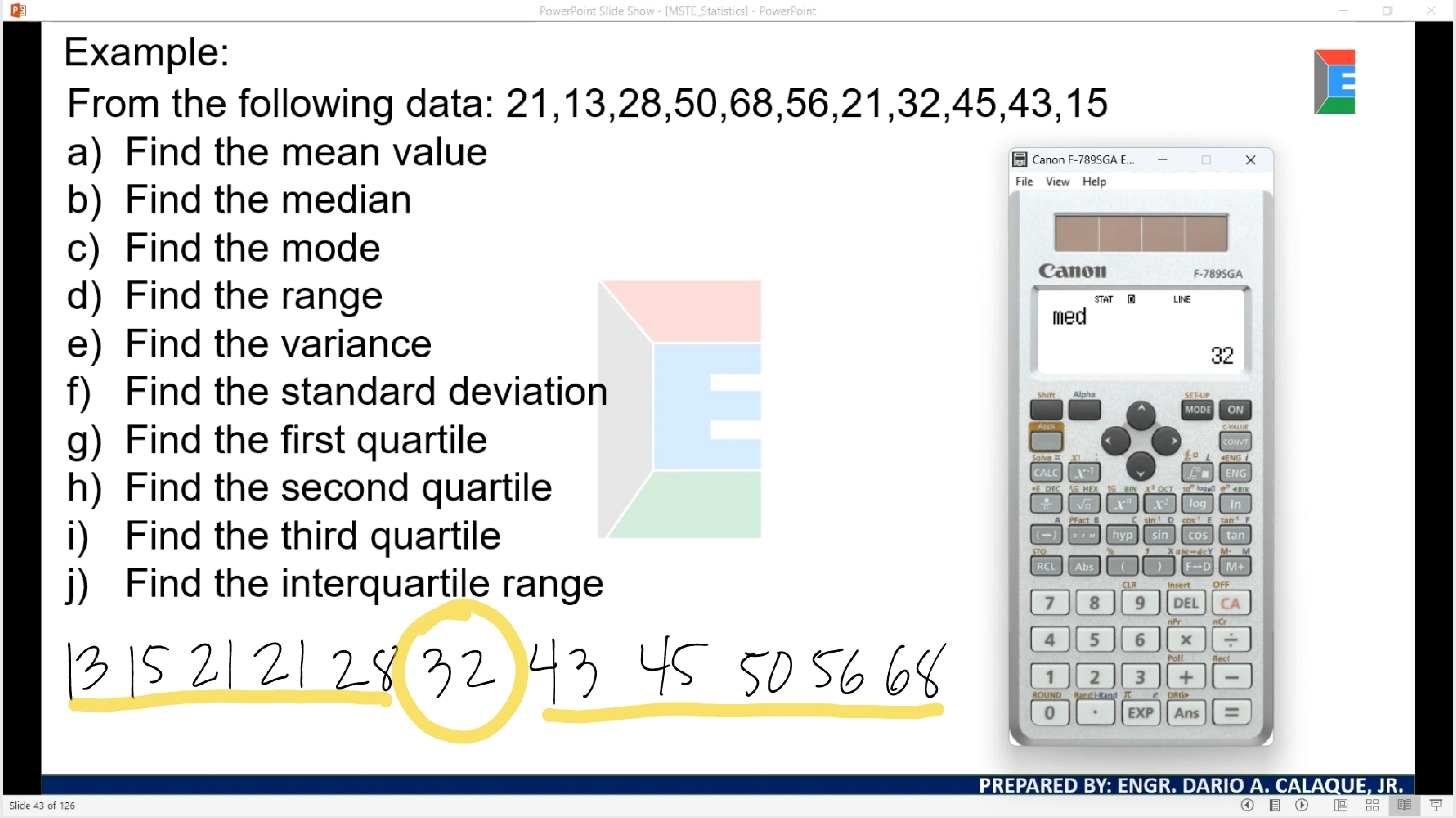
From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range

Mean =

$\bar{x}$

35.63636364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Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range

13 15 21 21 28 32 43 45 50 56 68

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Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
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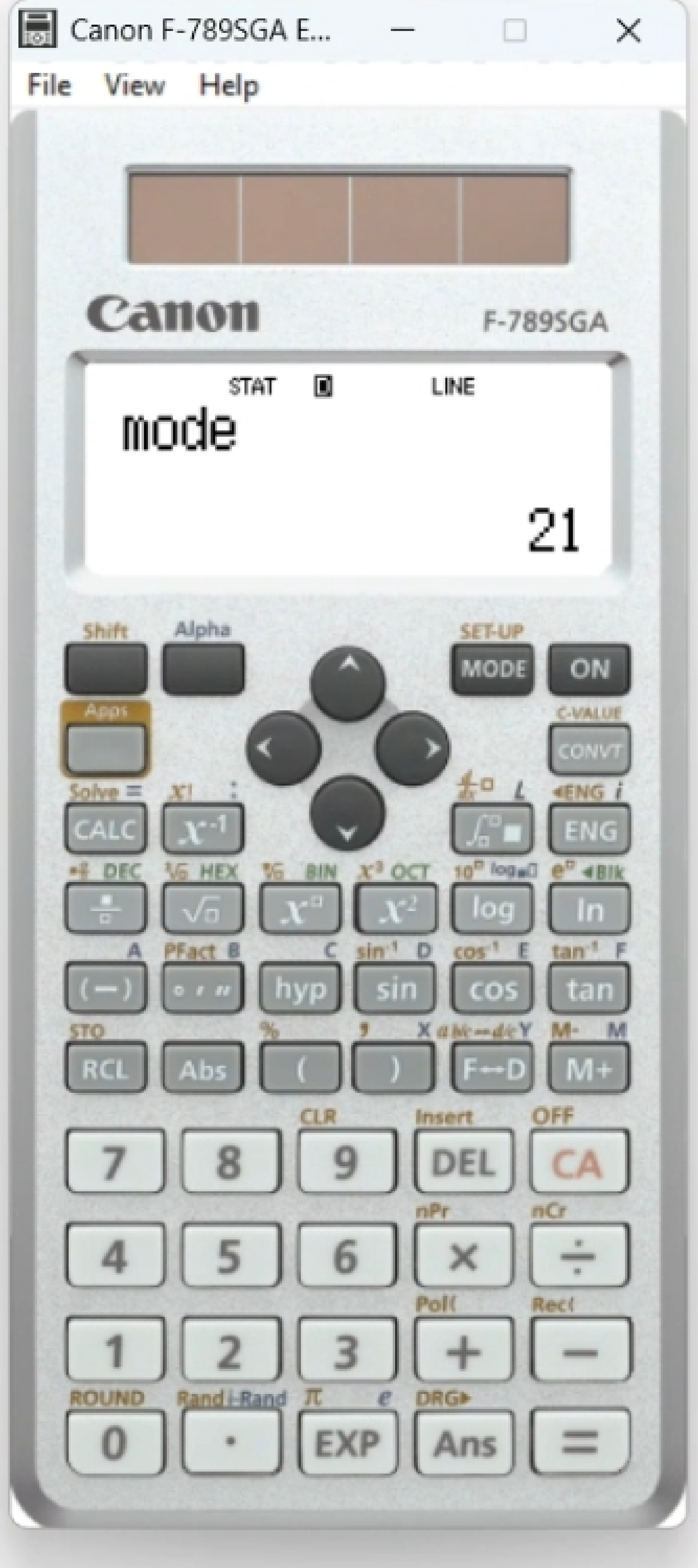
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range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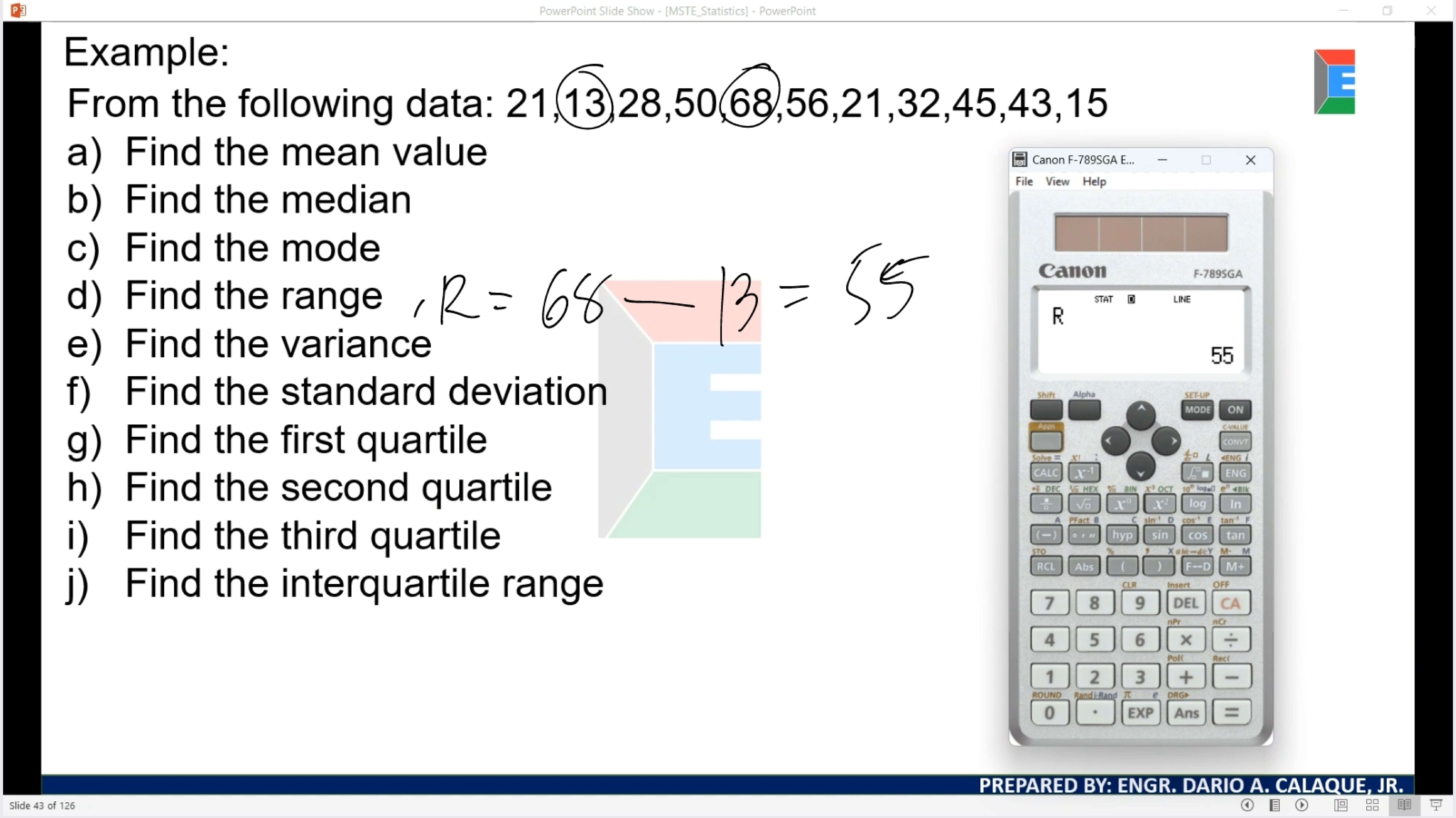
mode

21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R
55

Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range , $R = 68 - 13 = 55$
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range

PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint

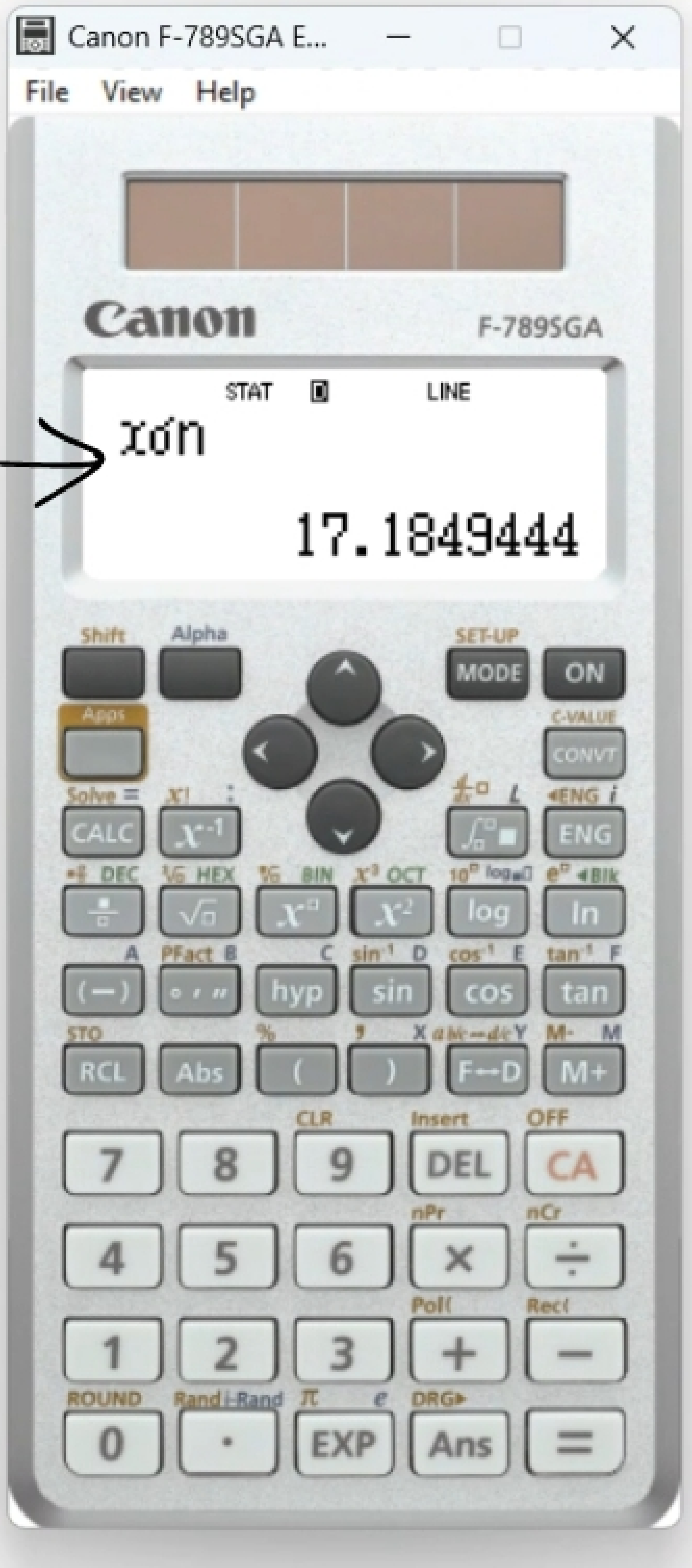
Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range

$v = \sigma^2$

Std. deviation.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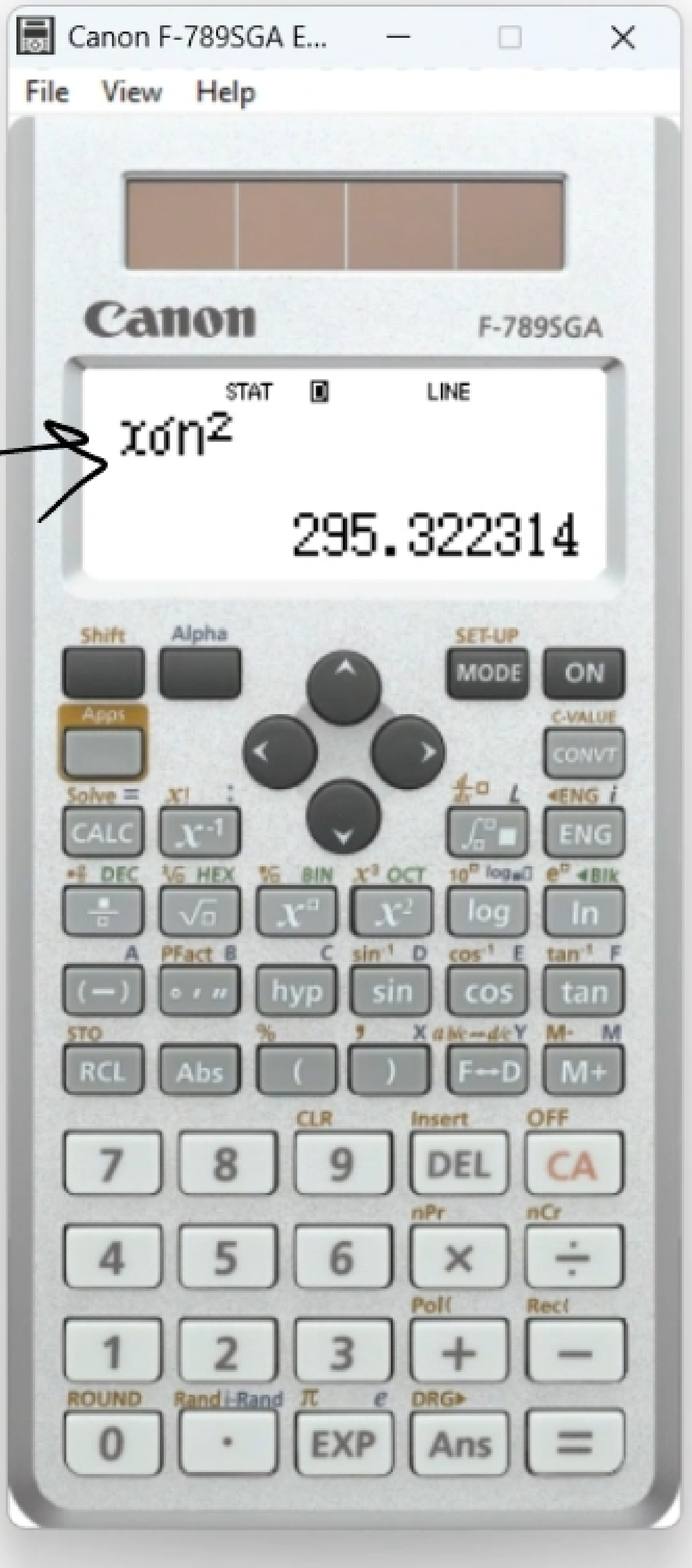
$x\sigma n$

17.1849444

Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range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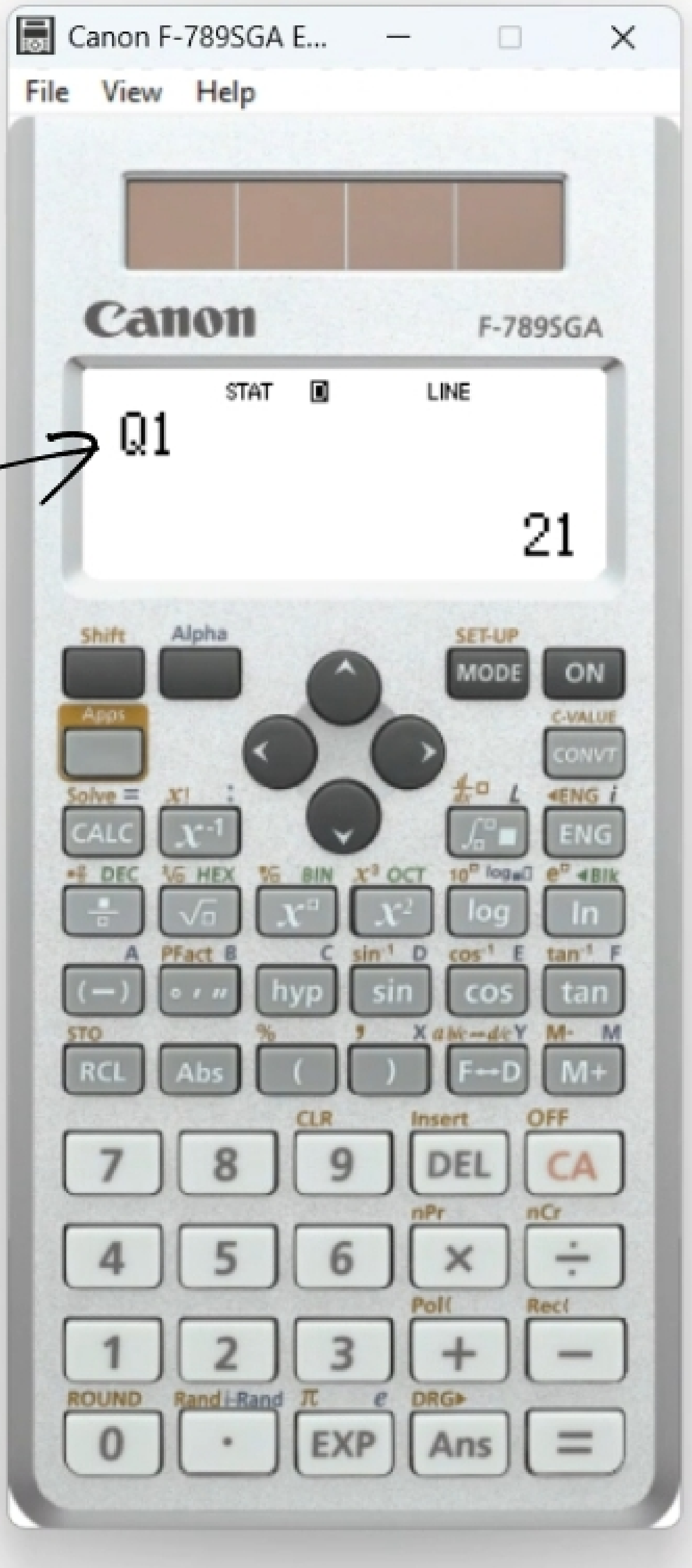
$x\sigma n^2$

295.322314

Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range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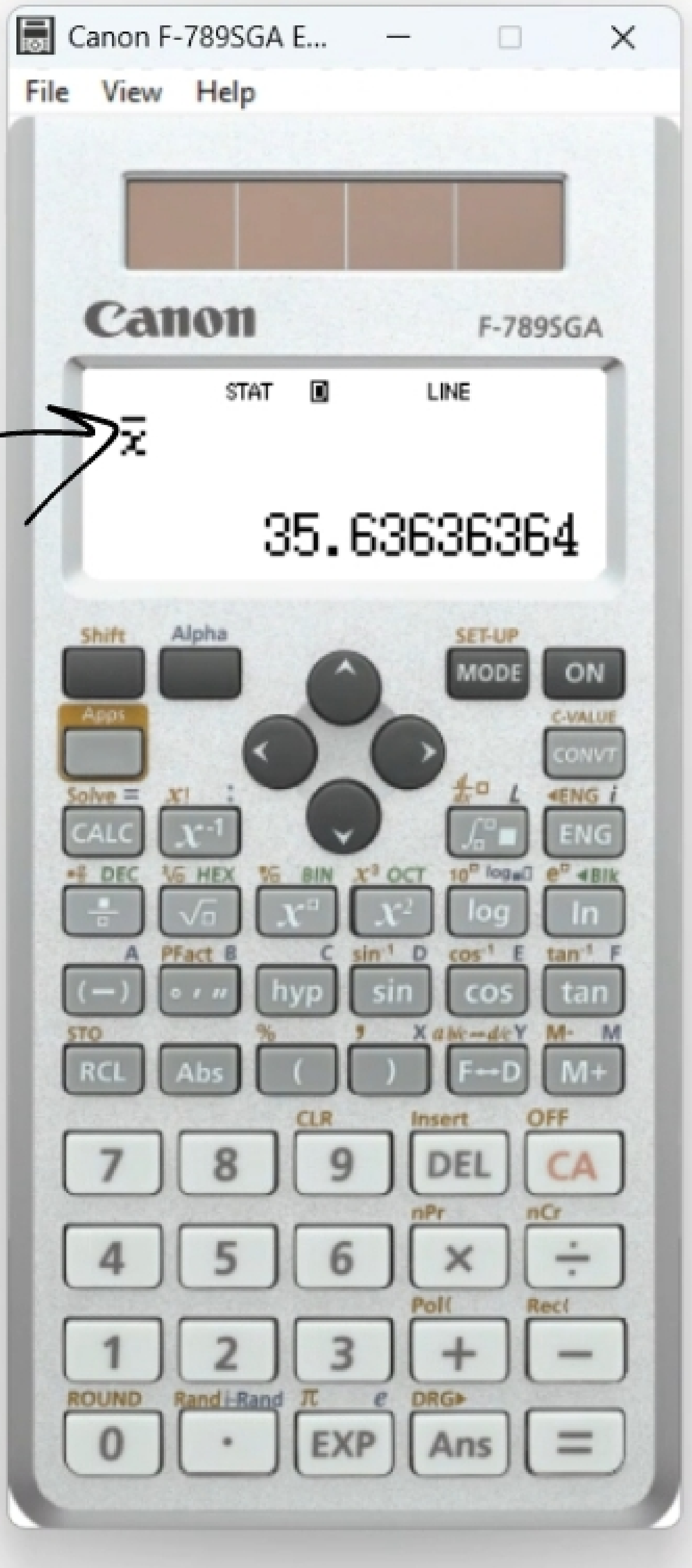
Q1
21

Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range

Mean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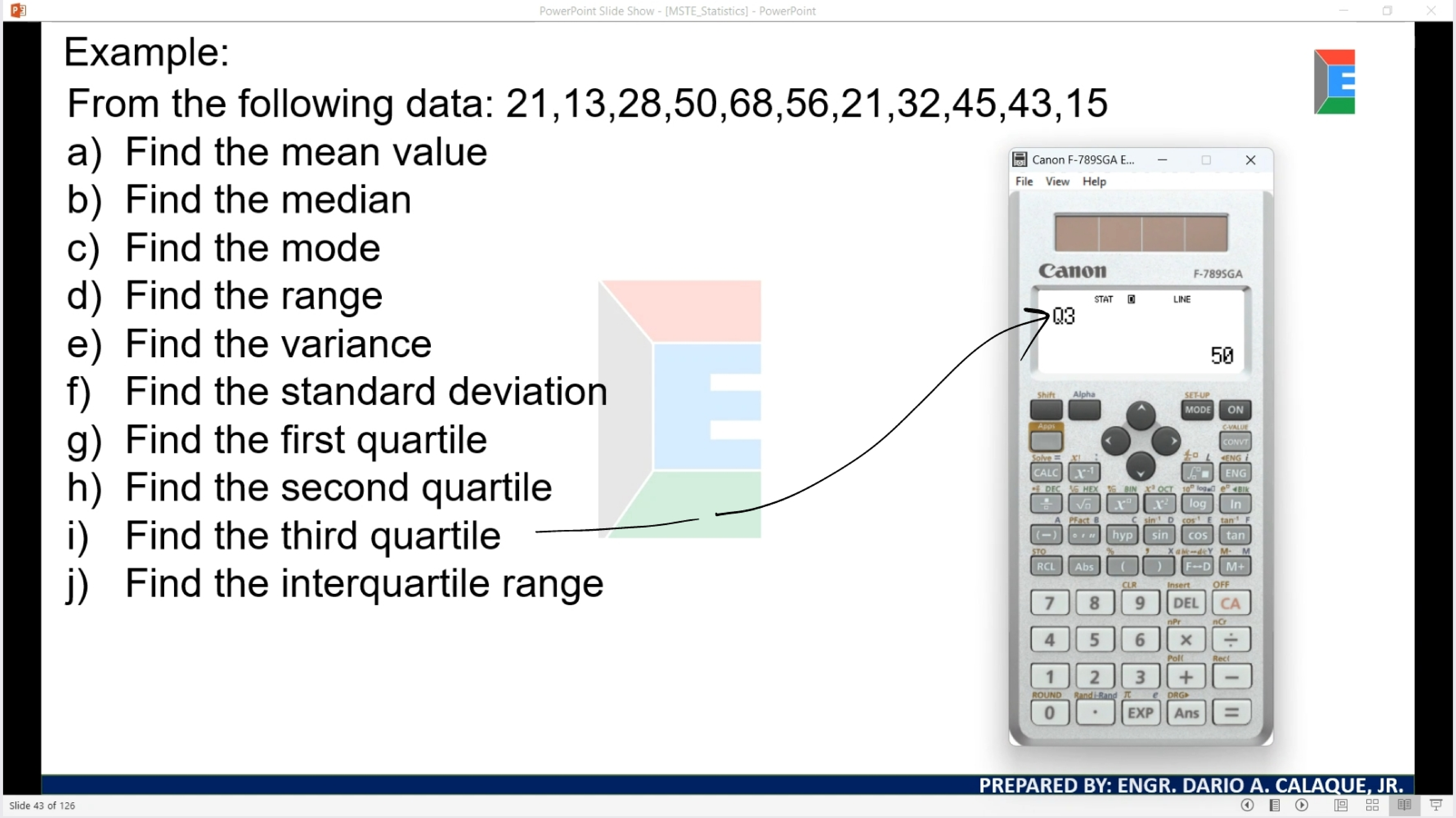
$\bar{x}$

35.63636364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Q3
50

Example:

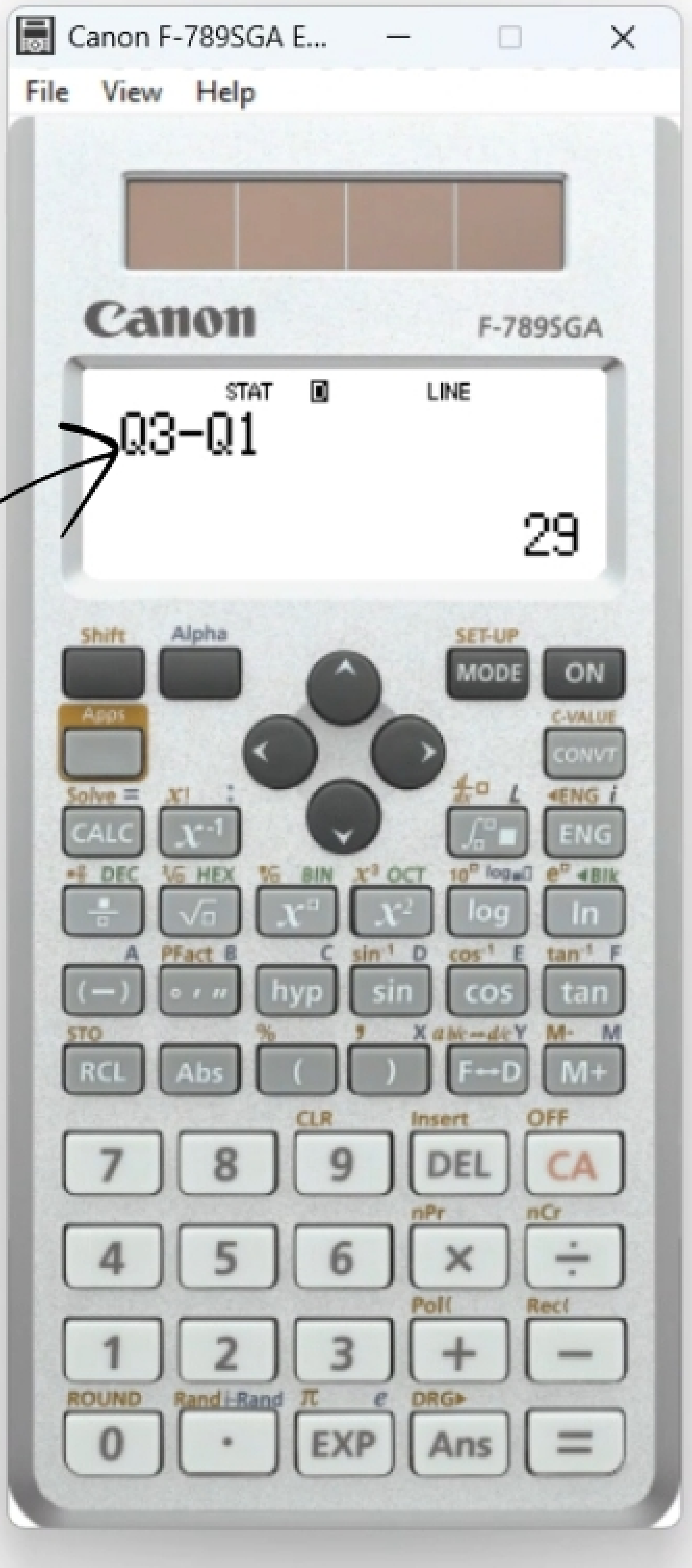
From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range

Example:

From the following data: 21,13,28,50,68,56,21,32,45,43,15

a) Find the mean value
b) Find the median
c) Find the mode
d) Find the range
e) Find the variance
f) Find the standard deviation
g) Find the first quartile
h) Find the second quartile
i) Find the third quartile
j) Find the interquartile range , IQR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Q3-Q1
29

Example:

From the following data:

10,11,12,25,25,27,31,33,34,34,35,36,43,50,59

a) Determine the first quartile

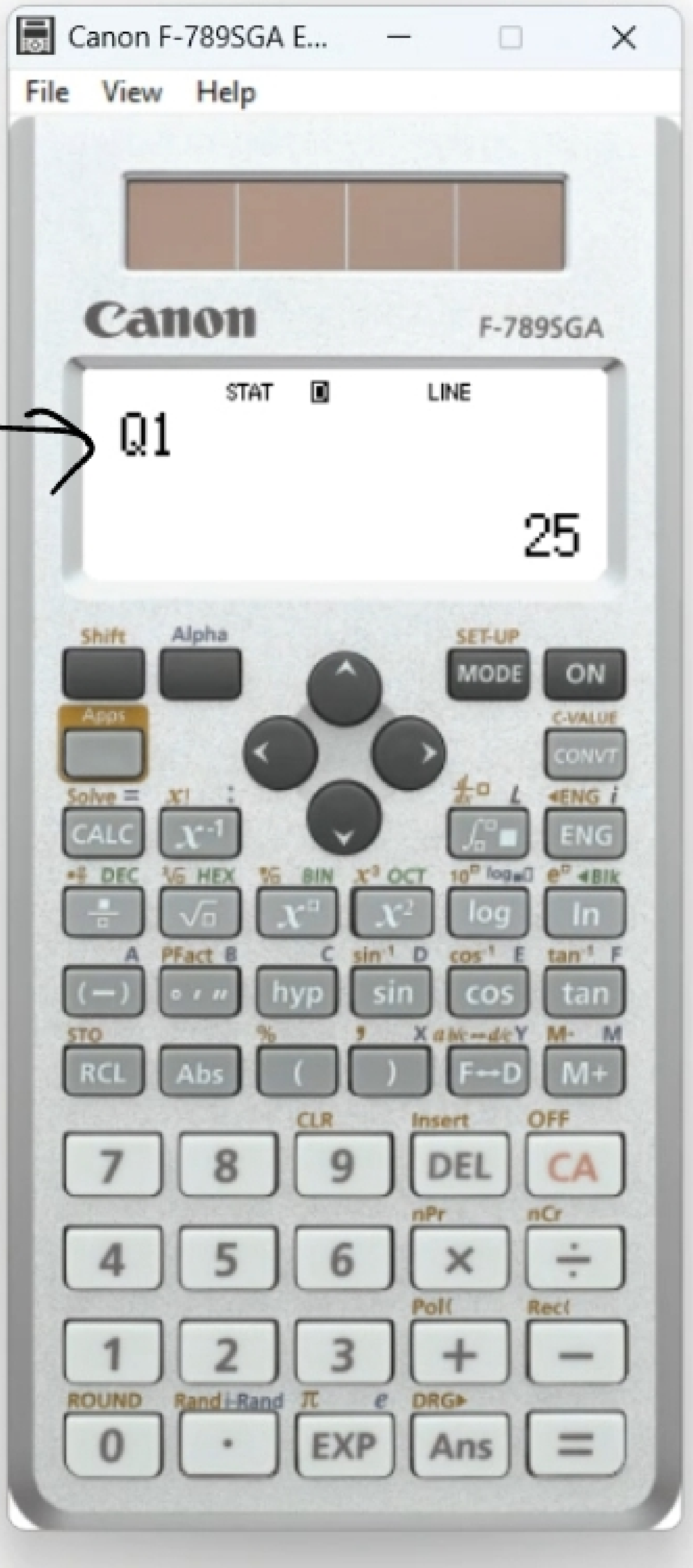
b) Determine the median

c) Determine the 3rd quartile

d) Determine the interquartile

e) Determine the range

f) Determine the outlier.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Q1
25

Example:

From the following data:

10,11,12,25,25,27,31,33,34,34,35,36,43,50,59

a) Determine the first quartile

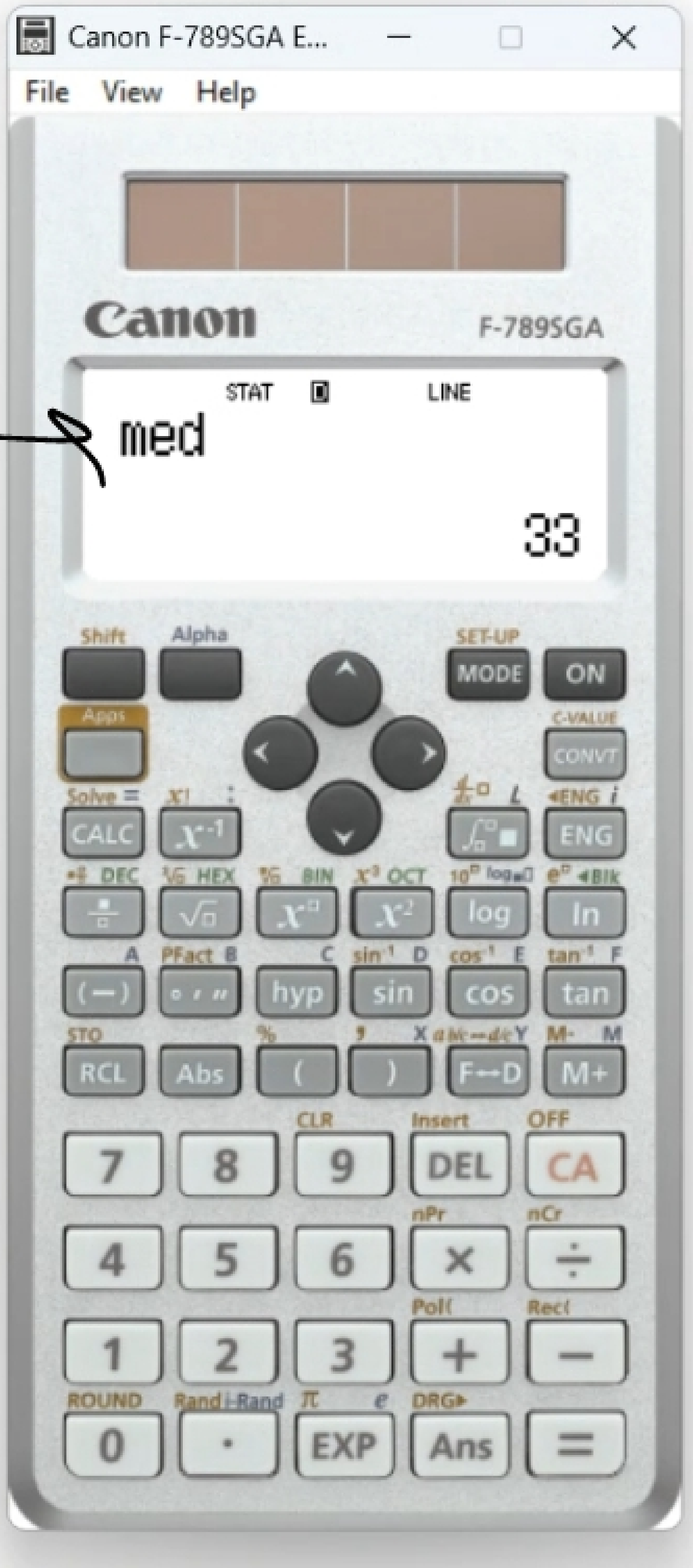
b) Determine the median

c) Determine the 3rd quartile

d) Determine the interquartile

e) Determine the range

f) Determine the outlier.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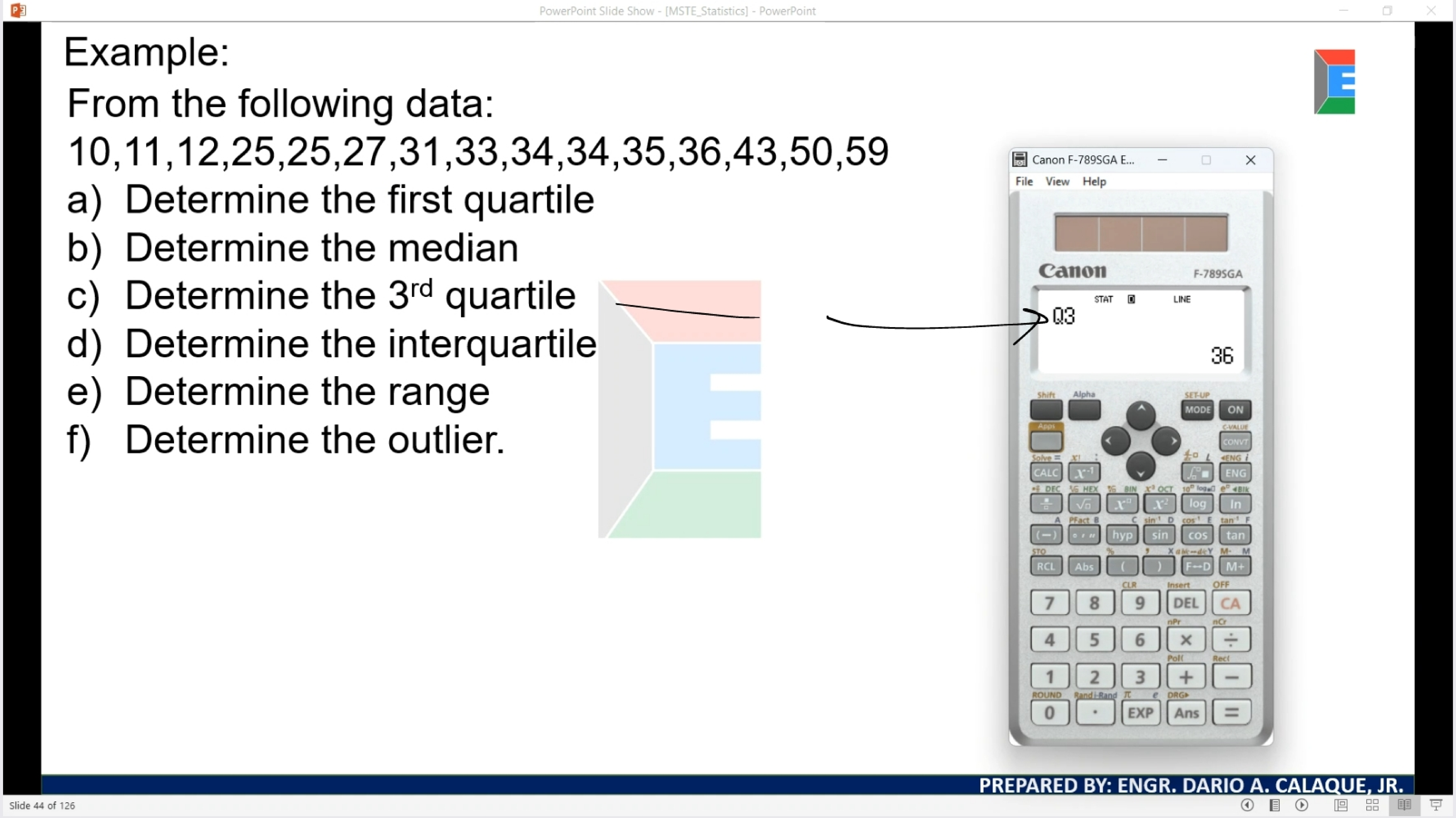
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Example:

From the following data:

10,11,12,25,25,27,31,33,34,34,35,36,43,50,59

a) Determine the first quartile

b) Determine the median

c) Determine the 3rd quartile

d) Determine the interquartile

e) Determine the range

f) Determine the outlier.

Q3

36

Example:

From the following data:

10,11,12,25,25,27,31,33,34,34,35,36,43,50,59

a) Determine the first quartile

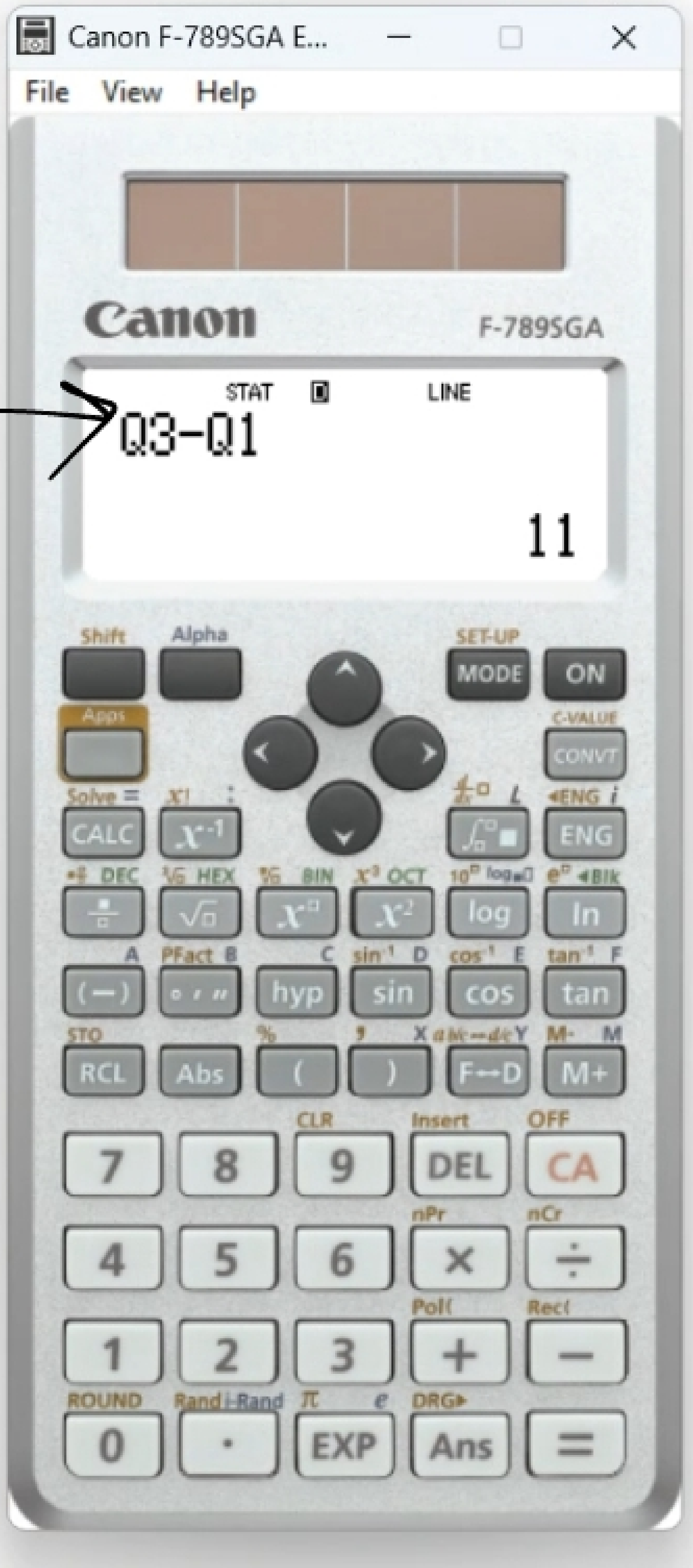
b) Determine the median

c) Determine the 3rd quartile

d) Determine the interquartile IQR

e) Determine the range

f) Determine the outlier.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Q3-Q1
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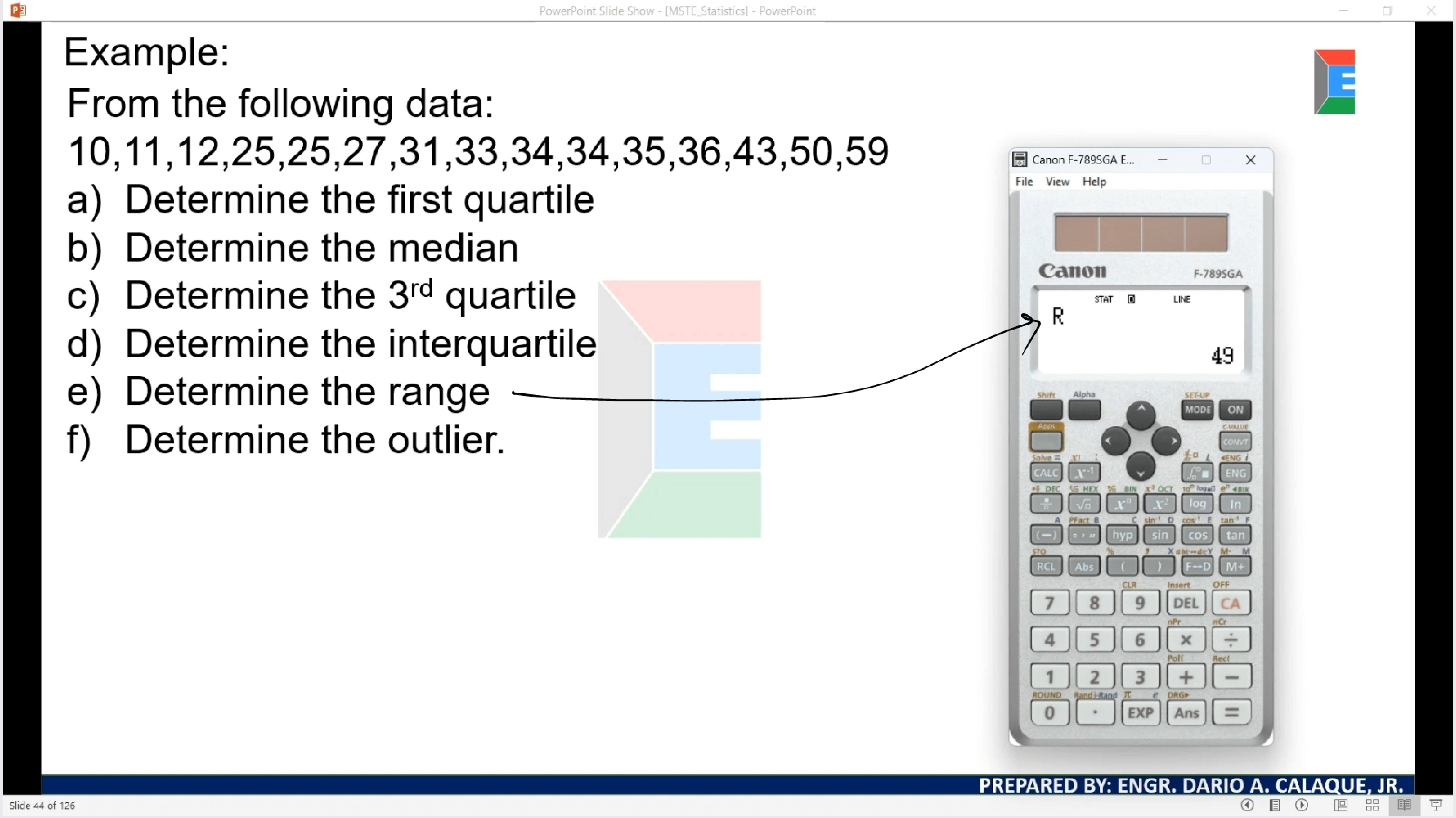
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Example:

From the following data:

10,11,12,25,25,27,31,33,34,34,35,36,43,50,59

a) Determine the first quartile
b) Determine the median
c) Determine the 3rd quartile
d) Determine the interquartile
e) Determine the range
f) Determine the outlier.

PREPARED BY: ENGR. DARIO A. CALAQUE, JR.

Example:

From the following data:

10,11,12,25,25,27,31,33,34,34,35,36,43,50,59

a) Determine the first quartile

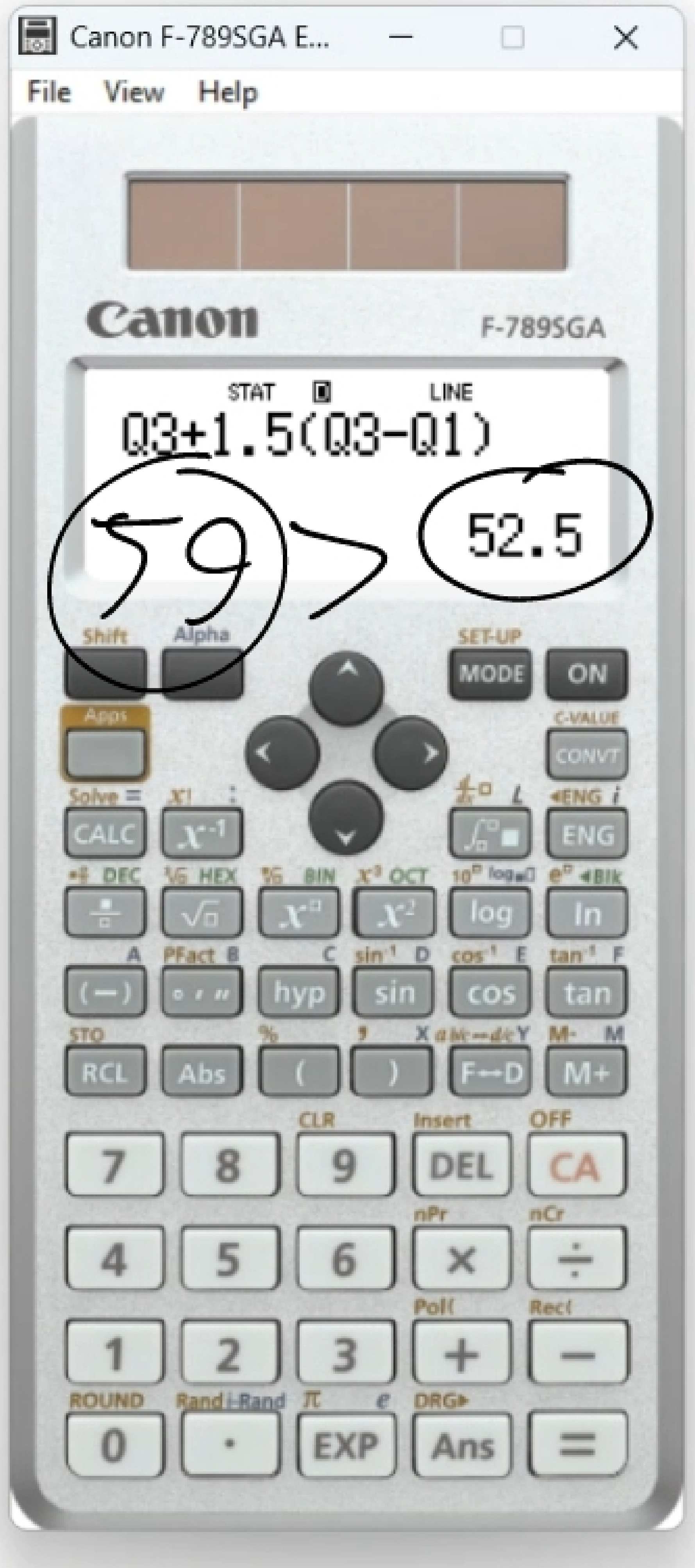
b) Determine the median

c) Determine the 3rd quartile

d) Determine the interquartile

e) Determine the range

f) Determine the outlier.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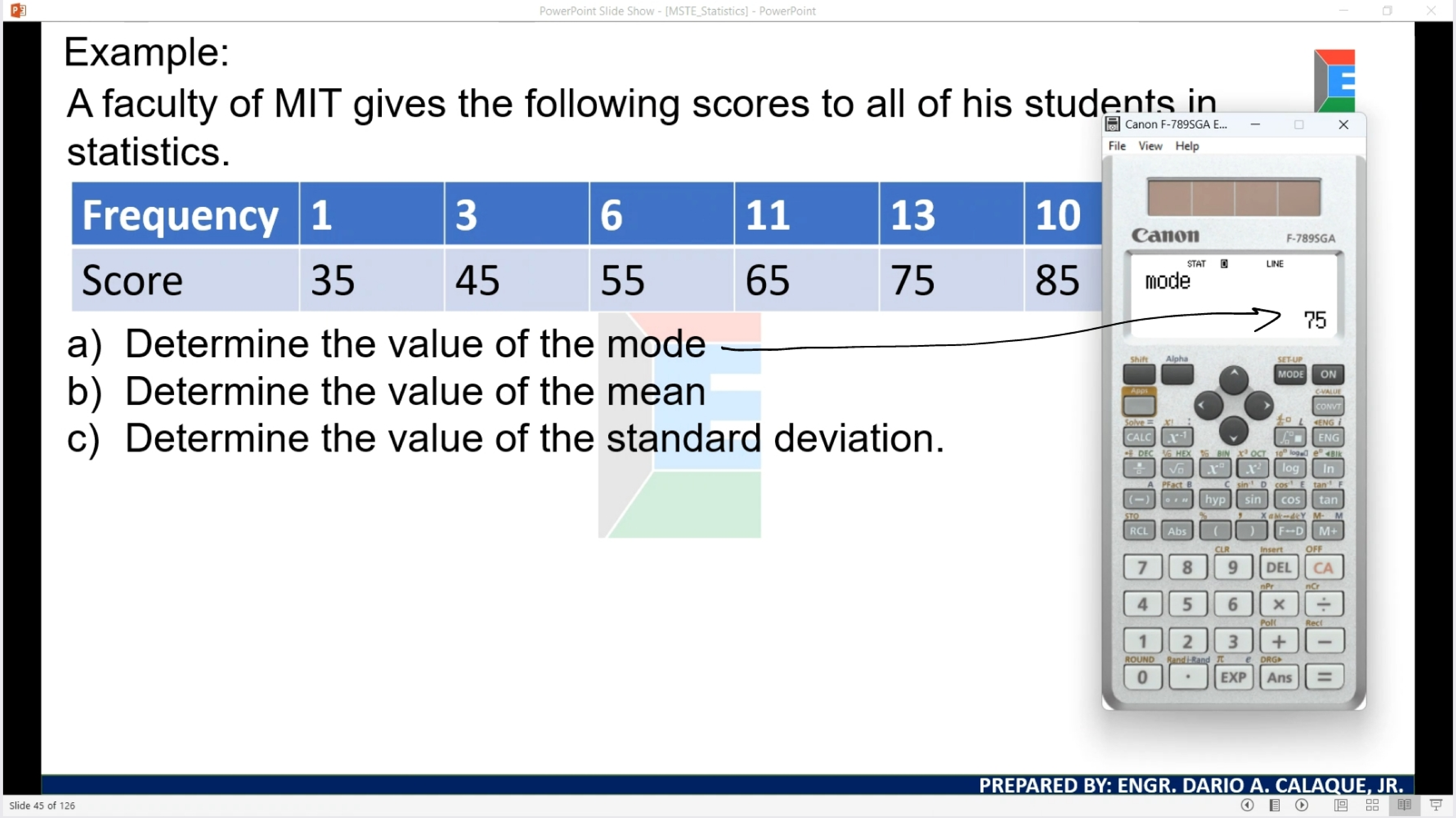
Q3+1.5(Q3-Q1)

59 > 52.5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Slide 45 of 126

Example:

A faculty of MIT gives the following scores to all of his students in statistics.

Frequency	1	3	6	11	13	10
Score	35	45	55	65	75	85

a) Determine the value of the mode

b) Determine the value of the mean

c) Determine the value of the standard deviation.

mode

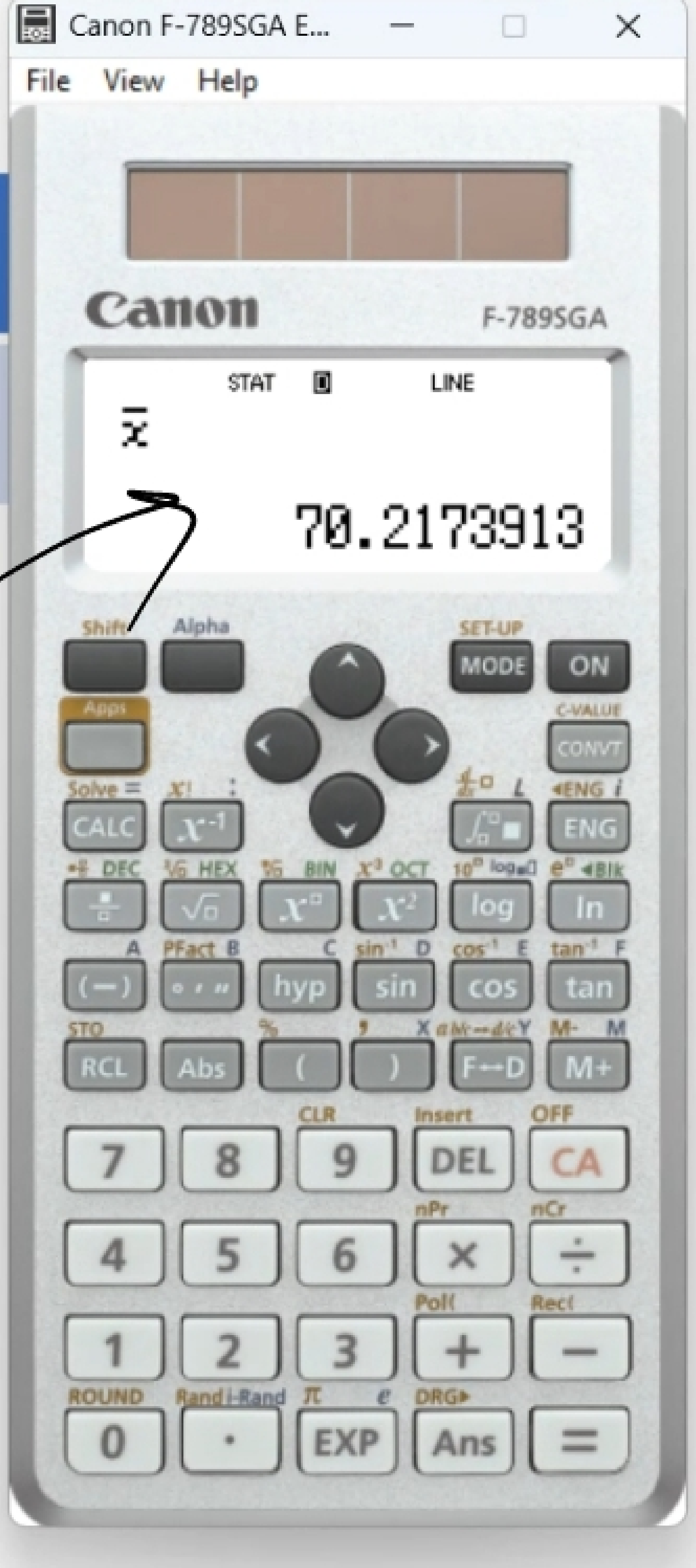
75

Example:

A faculty of MIT gives the following scores to all of his students in statistics.

Frequency	1	3	6	11	13	10
Score	35	45	55	65	75	85

a) Determine the value of the mode
b) Determine the value of the mean
c) Determine the value of the standard deviation.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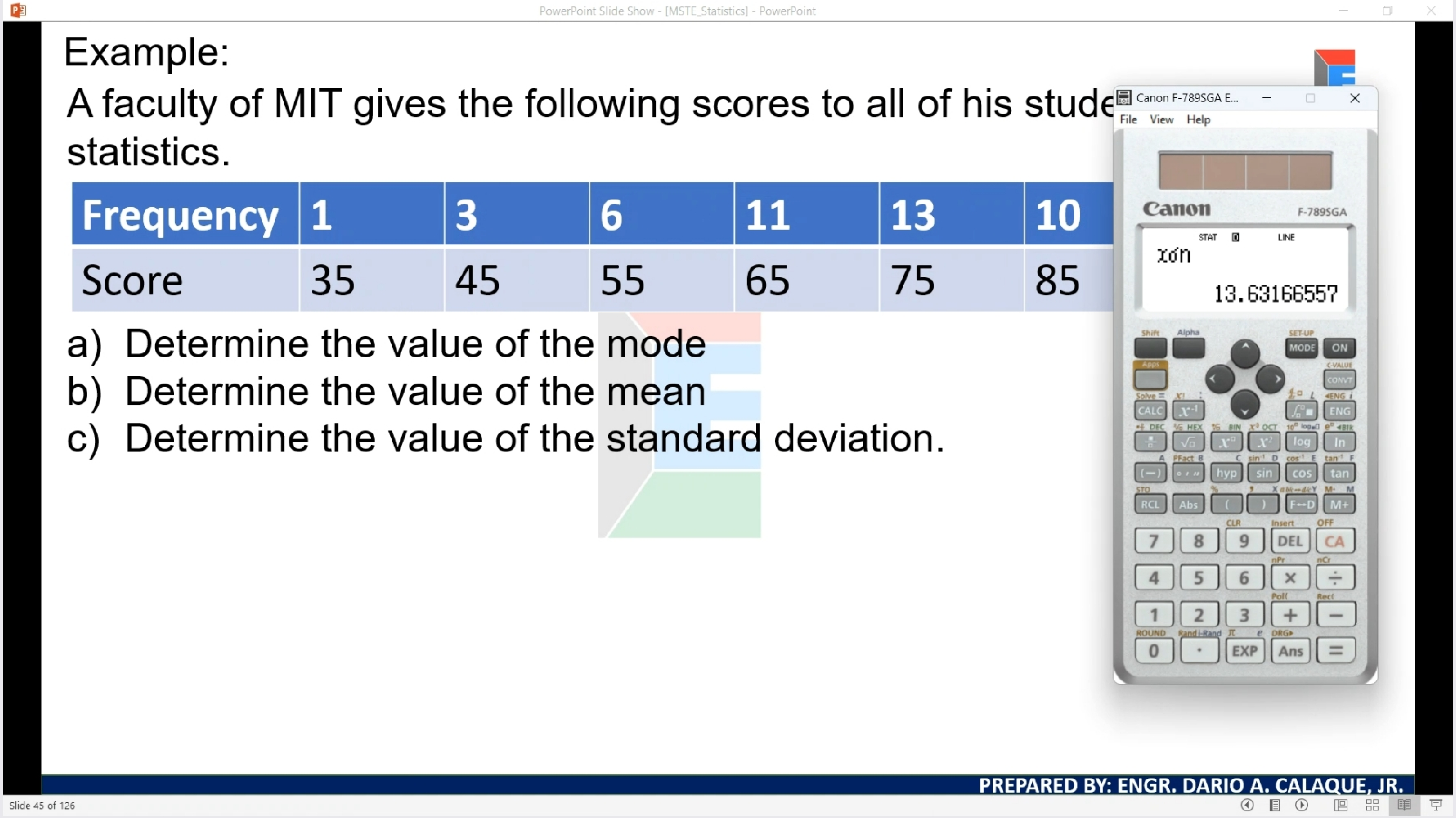
$\bar{x}$

70.2173913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Slide 45 of 126

Example:

A faculty of MIT gives the following scores to all of his stude
statistics.

Frequency	**1**	**3**	**6**	**11**	**13**	**10**
Score	35	45	55	65	75	85

a) Determine the value of the mode
b) Determine the value of the mean
c) Determine the value of the standard deviation.

PAST CEB EXAM MAY 2013

A set has 5 items and it has a range of 7. The set is composed of the following: $\{1,2,M,5,M^2\}$ with M>0.

Find the average of the number set.

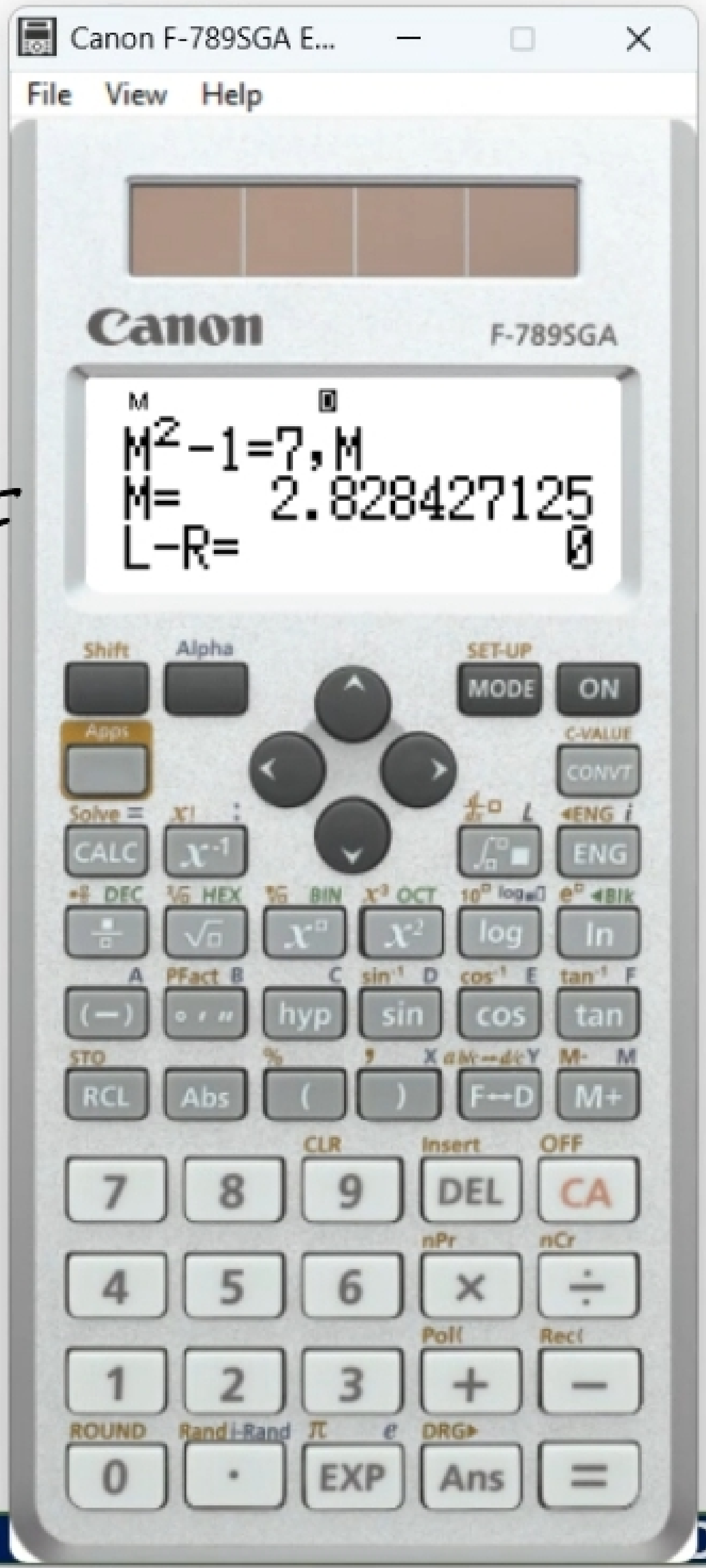
a) 4.75

b) 3.76

c) 2.89

d) 5.06

$R = \text{max.} X - \text{min.} X =$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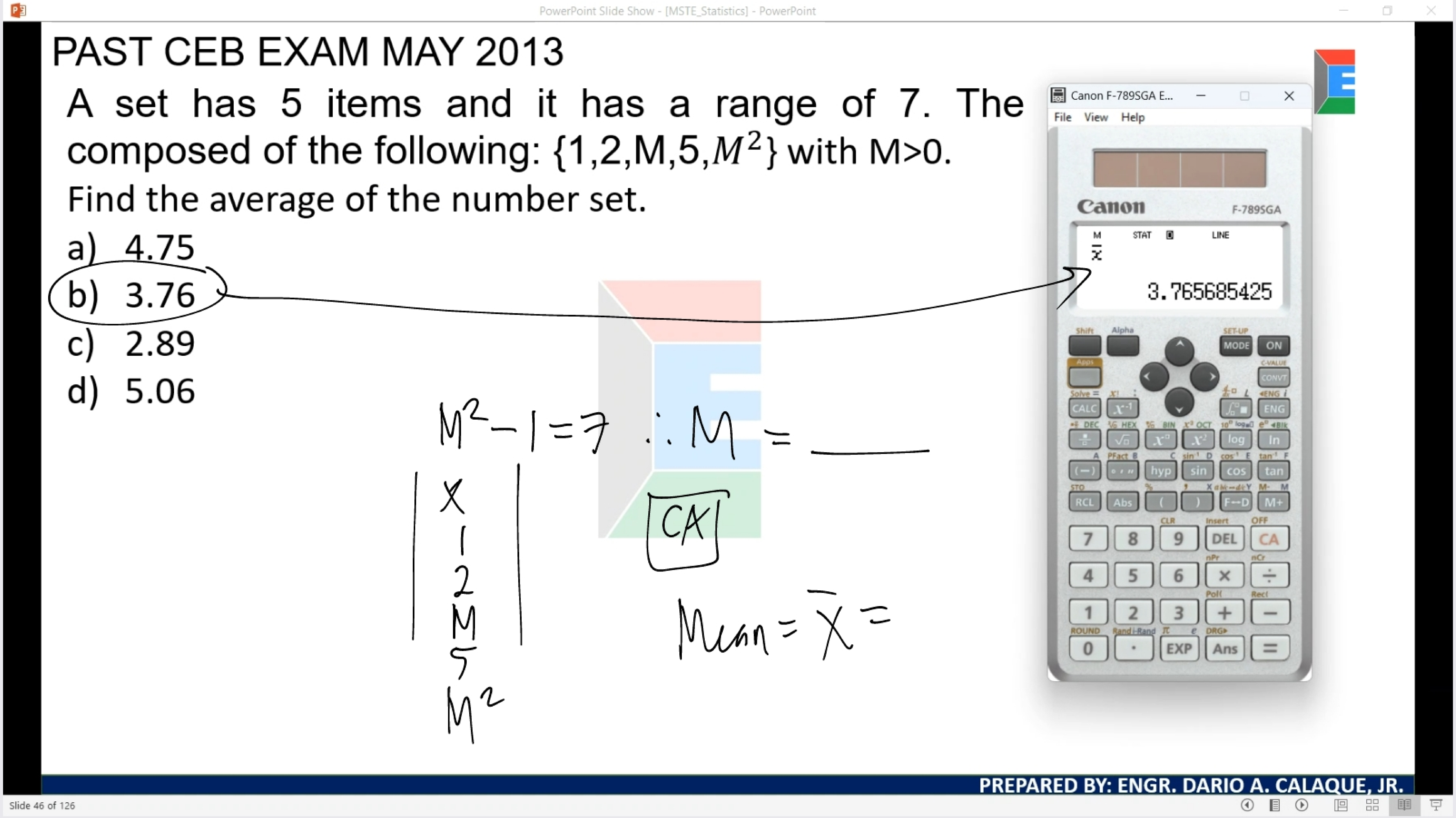
M

$M^2-1=7,M$

M= 2.828427125

L-R= 0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Canon F-789SGA E...
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$\bar{x}$

PAST CEB EXAM MAY 2013

A set has 5 items and it has a range of 7. The composed of the following: {1,2,M,5,M^2} with M>0.

Find the average of the number set.

- a) 4.75
- [✓ b) 3.76]
- c) 2.89
- d) 5.06

3.765685425

$M^2 - 1 = 7 \therefore M =$ ______

X
1
2
M
5
M^2

$\boxed{CA}$

Mean $= \bar{X} =$

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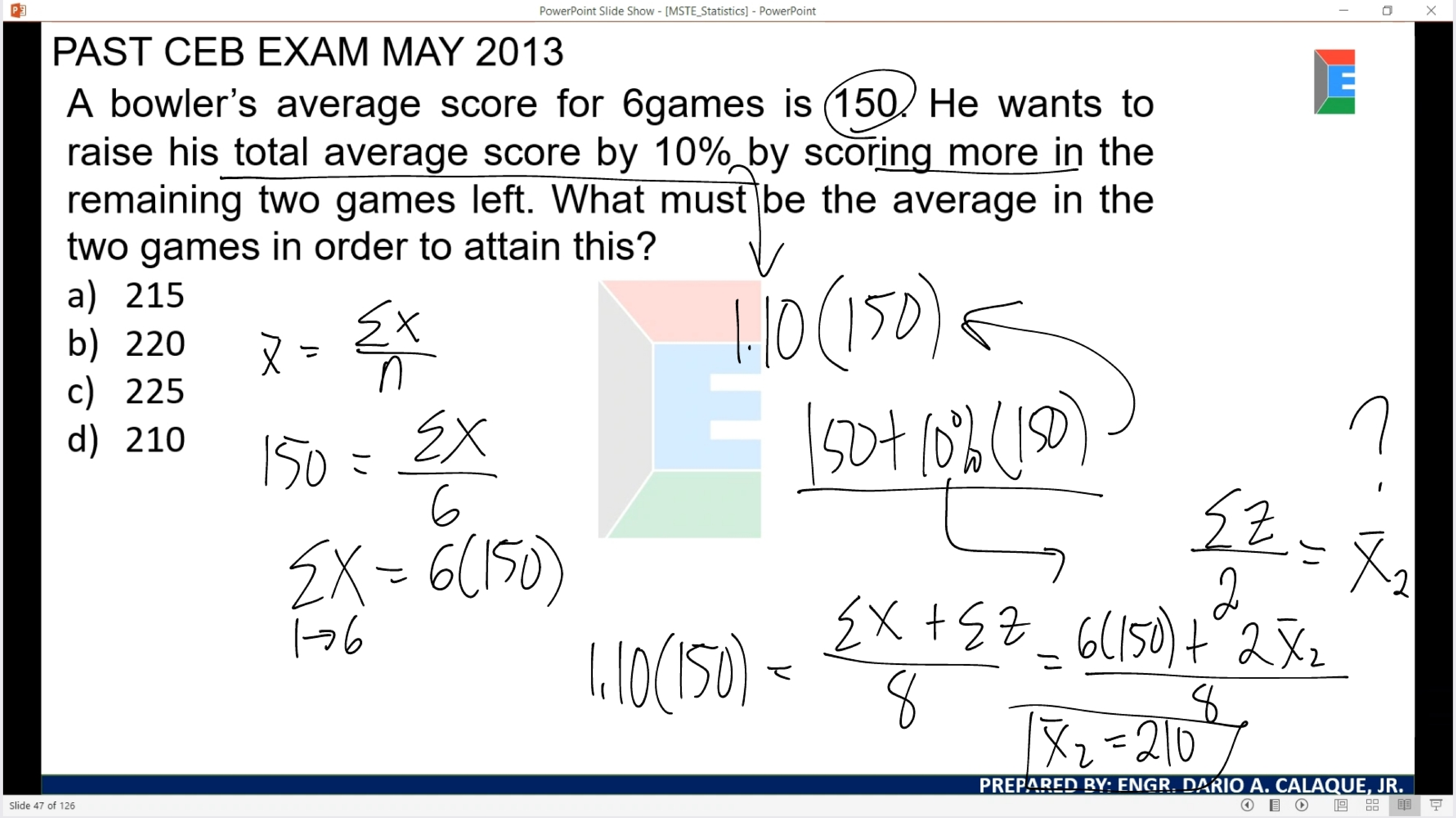
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PAST CEB EXAM MAY 2013

A bowler's average score for 6games is 150. He wants to raise his total average score by 10% by scoring more in the remaining two games left. What must be the average in the two games in order to attain this?

a) 215

b) 220

c) 225

d) 210

$$\bar{x} = \frac{\sum x}{n}$$

$$150 = \frac{\sum X}{6}$$

$$\sum_{1\to 6} X = 6(150)$$

$$1.10(150)$$

$$150 + 10\%(150)$$

?

$$\frac{\sum z}{2} = \bar{X}_2$$

$$1.10(150) = \frac{\sum X + \sum z}{8} = \frac{6(150) + 2\bar{X}_2}{8}$$

$$\boxed{\bar{X}_2 = 210}$$

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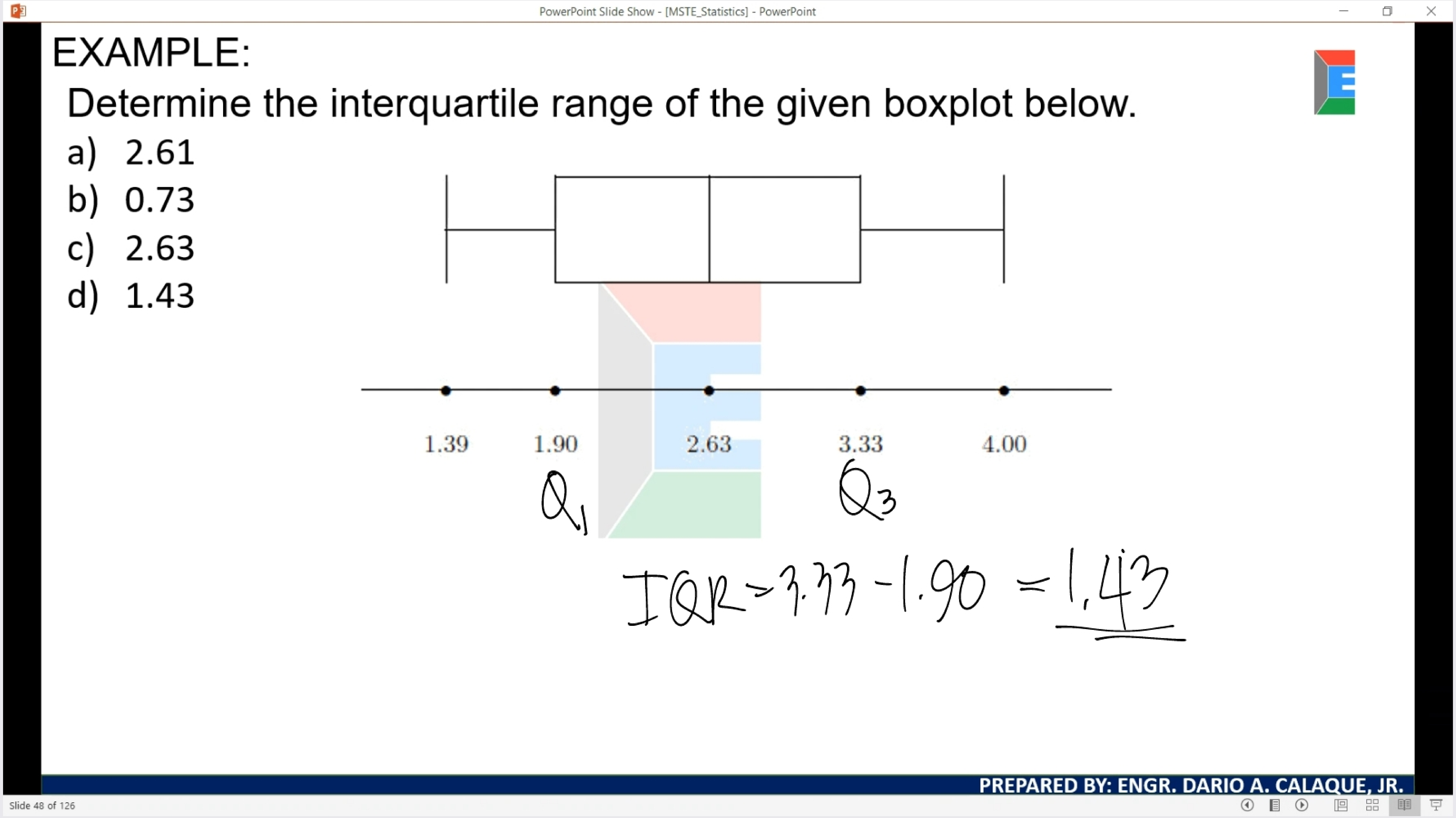
PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
1.39
1.90
2.63
3.33
4.00
Slide 48 of 126

EXAMPLE:

Determine the interquartile range of the given boxplot below.

a) 2.61
b) 0.73
c) 2.63
d) 1.43

Q_1 Q_3

$IQR = 3.33 - 1.90 = \underline{1.43}$

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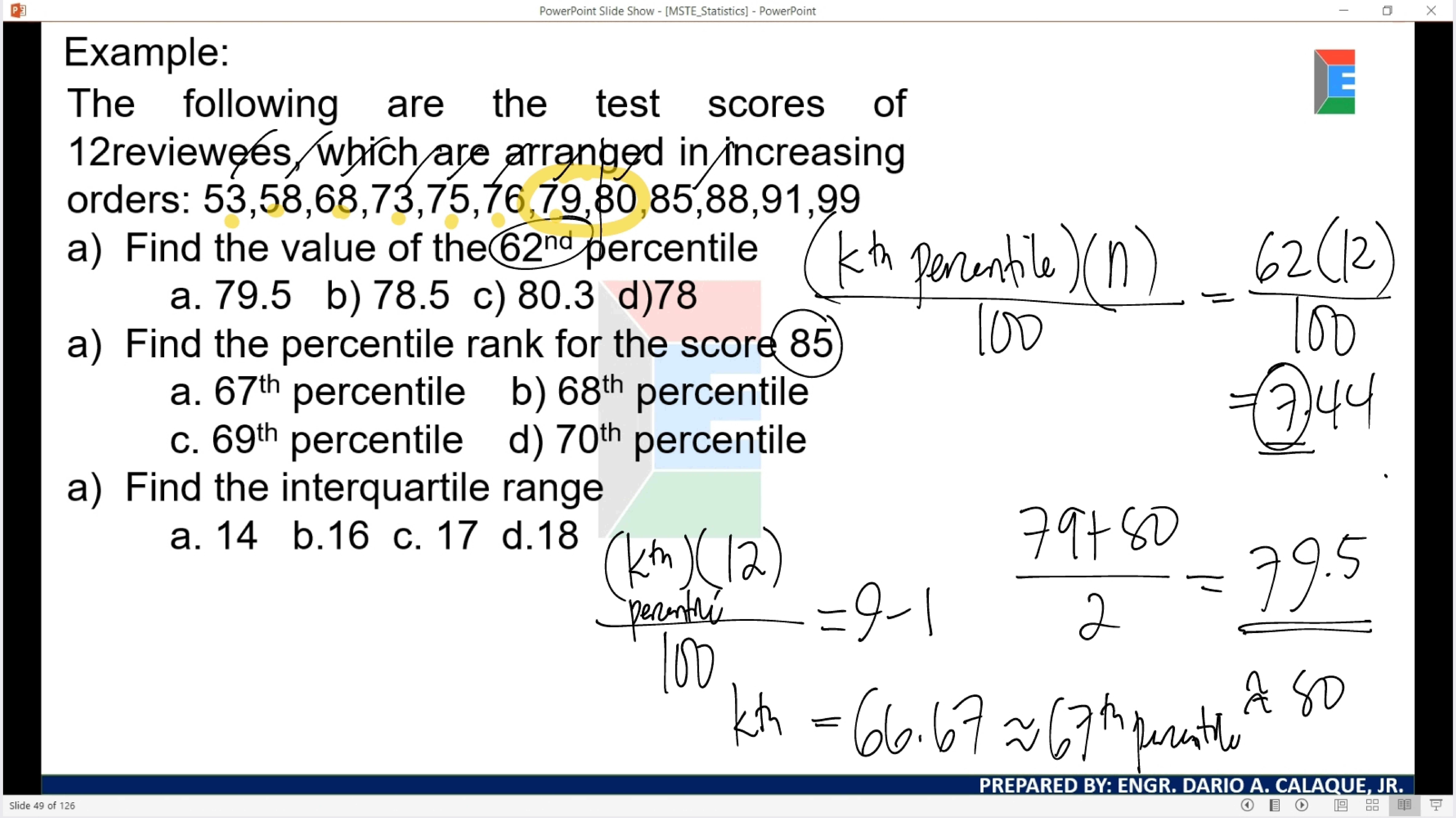

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Example:

The following are the test scores of 12reviewees, which are arranged in increasing orders: 53,58,68,73,75,76,79,80,85,88,91,99

a) Find the value of the 62nd percentile

a. 79.5 b) 78.5 c) 80.3 d)78

a) Find the percentile rank for the score 85

a. 67th percentile b) 68th percentile

c. 69th percentile d) 70th percentile

a) Find the interquartile range

a. 14 b.16 c. 17 d.18

$$\frac{(k^{th}\ \text{percentile})(n)}{100} = \frac{62(12)}{100}$$

$$= \boxed{7}.44$$

$$\frac{79+80}{2} = 79.5$$

$$\frac{(k^{th})(12)\ \text{percentile}}{100} = 9-1$$

$k^{th} = 66.67 \approx 67^{th}$ percentile ≈ 80

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Example:

The following are the test scores of 12reviewees, which are arranged in increasing orders: 53,58,68,73,75,76,79,80,85,88,91,99

a) Find the value of the 62nd percentile

a. 79.5 b) 78.5 c) 80.3 d)78

a) Find the percentile rank for the score 85

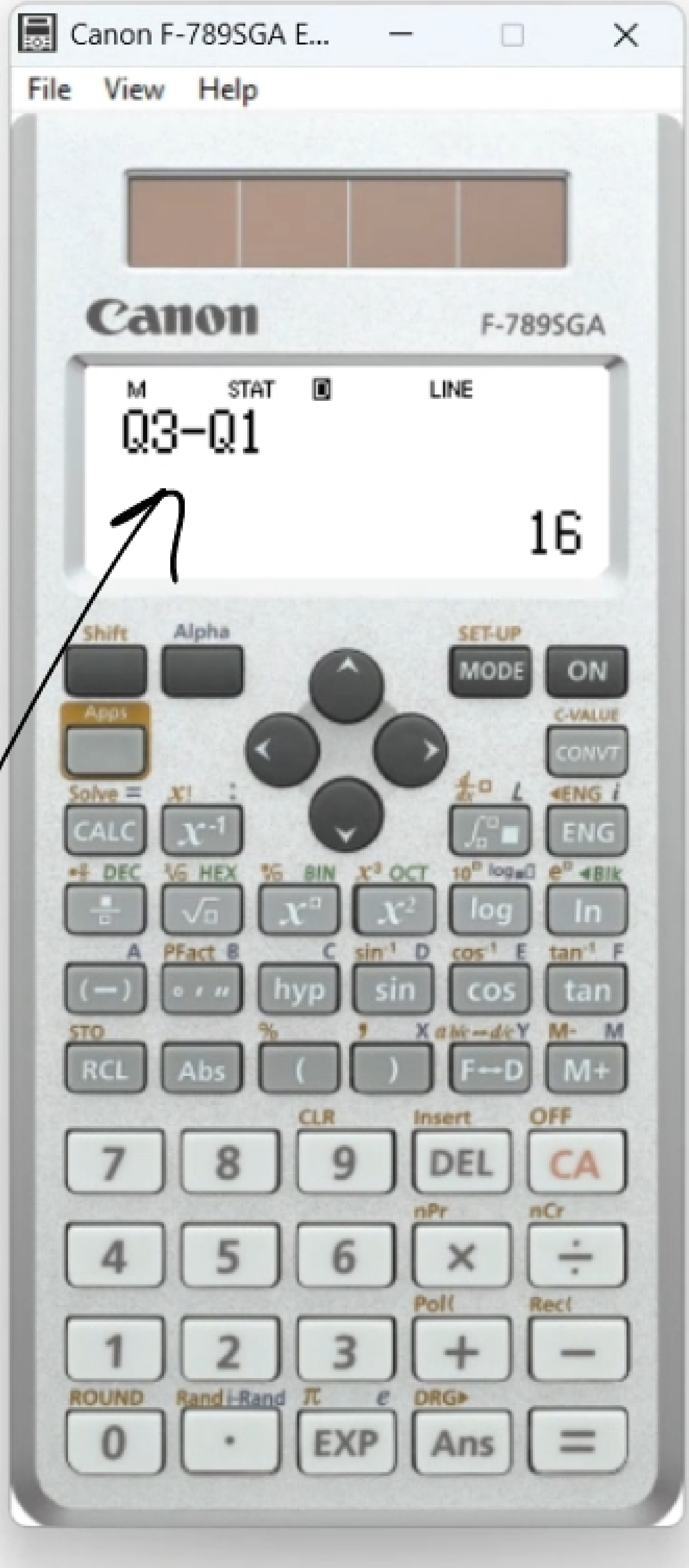
a. 67th percentile b) 68th percentile

c. 69th percentile d) 70th percentile

a) Find the interquartile range

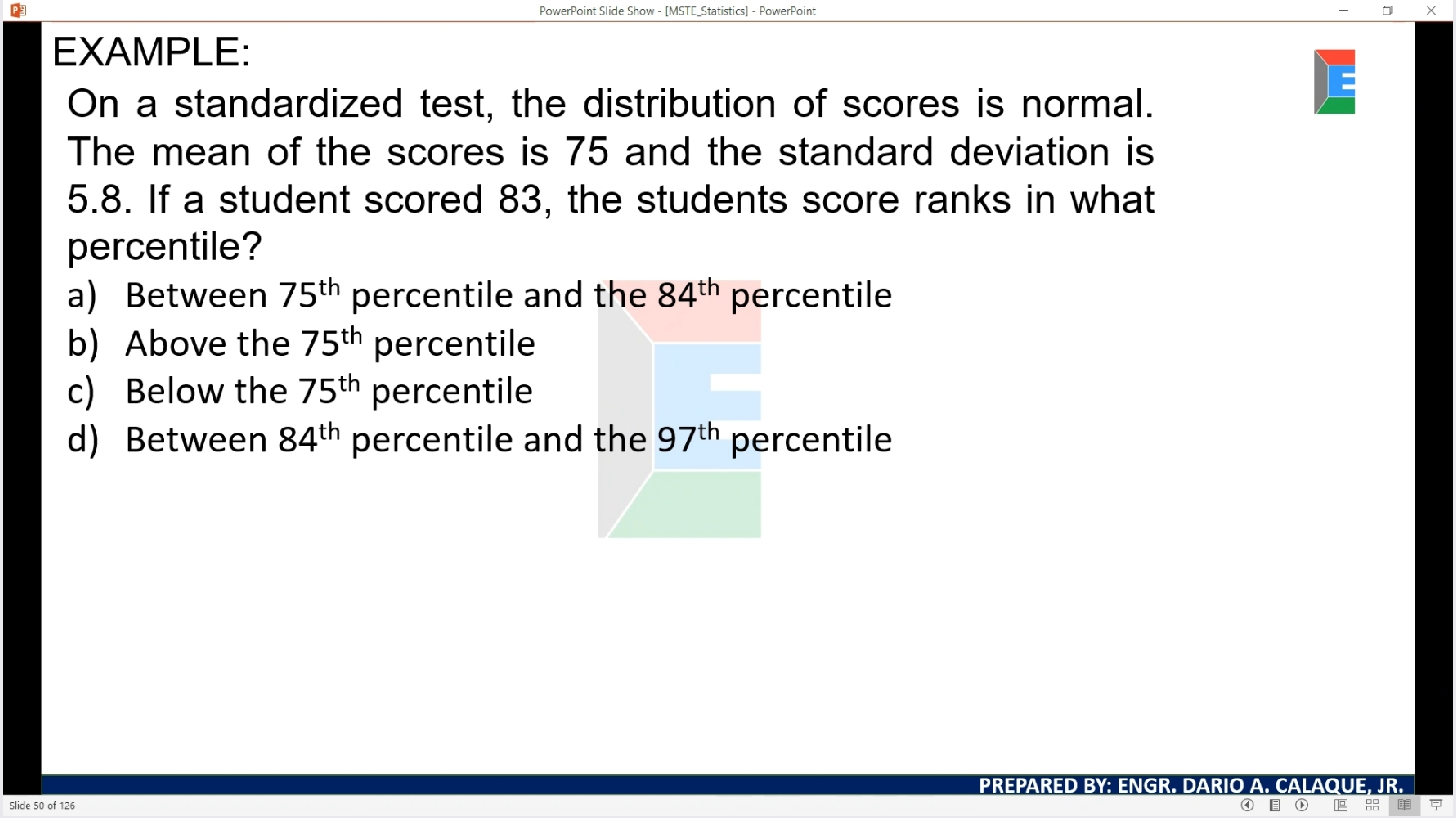
a. 14 [✓ b.16] c. 17 d.18

$IQR = Q_3 - Q_1$



Q3−Q1

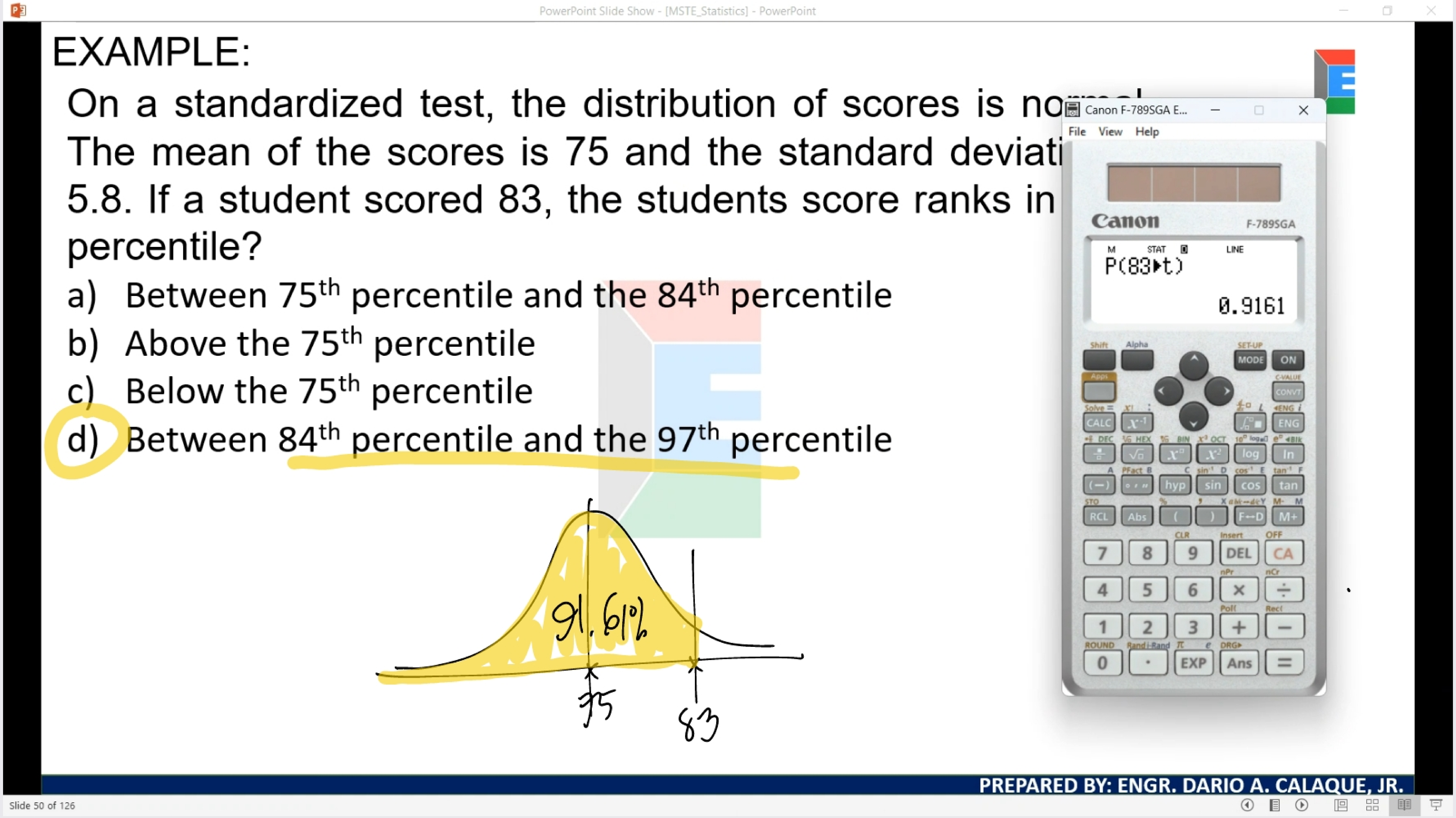
16


PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
Slide 50 of 126

EXAMPLE:

On a standardized test, the distribution of scores is normal. The mean of the scores is 75 and the standard deviation is 5.8. If a student scored 83, the students score ranks in what percentile?

a) Between 75th percentile and the 84th percentile
b) Above the 75th percentile
c) Below the 75th percentile
d) Between 84th percentile and the 97th percentile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=
91.61%
75
83
Slide 50 of 126

EXAMPLE:

On a standardized test, the distribution of scores is no
The mean of the scores is 75 and the standard deviati
5.8. If a student scored 83, the students score ranks in
percentile?

a) Between 75th percentile and the 84th percentile

b) Above the 75th percentile

c) Below the 75th percentile

[✓ d)] Between 84th percentile and the 97th percentile

```
P(83▶t)
                0.9161
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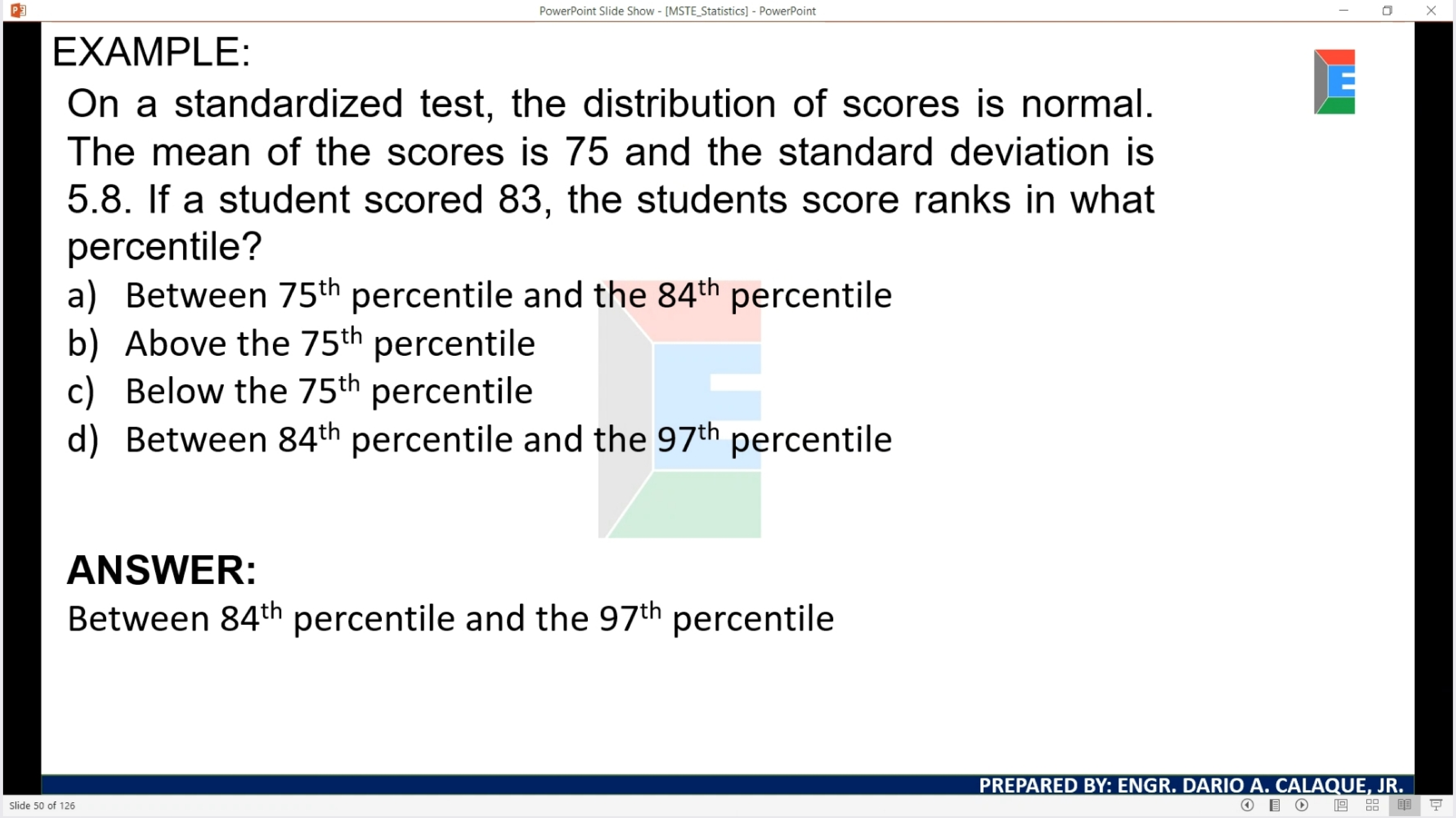
PREPARED BY: ENGR. DARIO A. CALAQUE, JR.


PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint
Slide 50 of 126

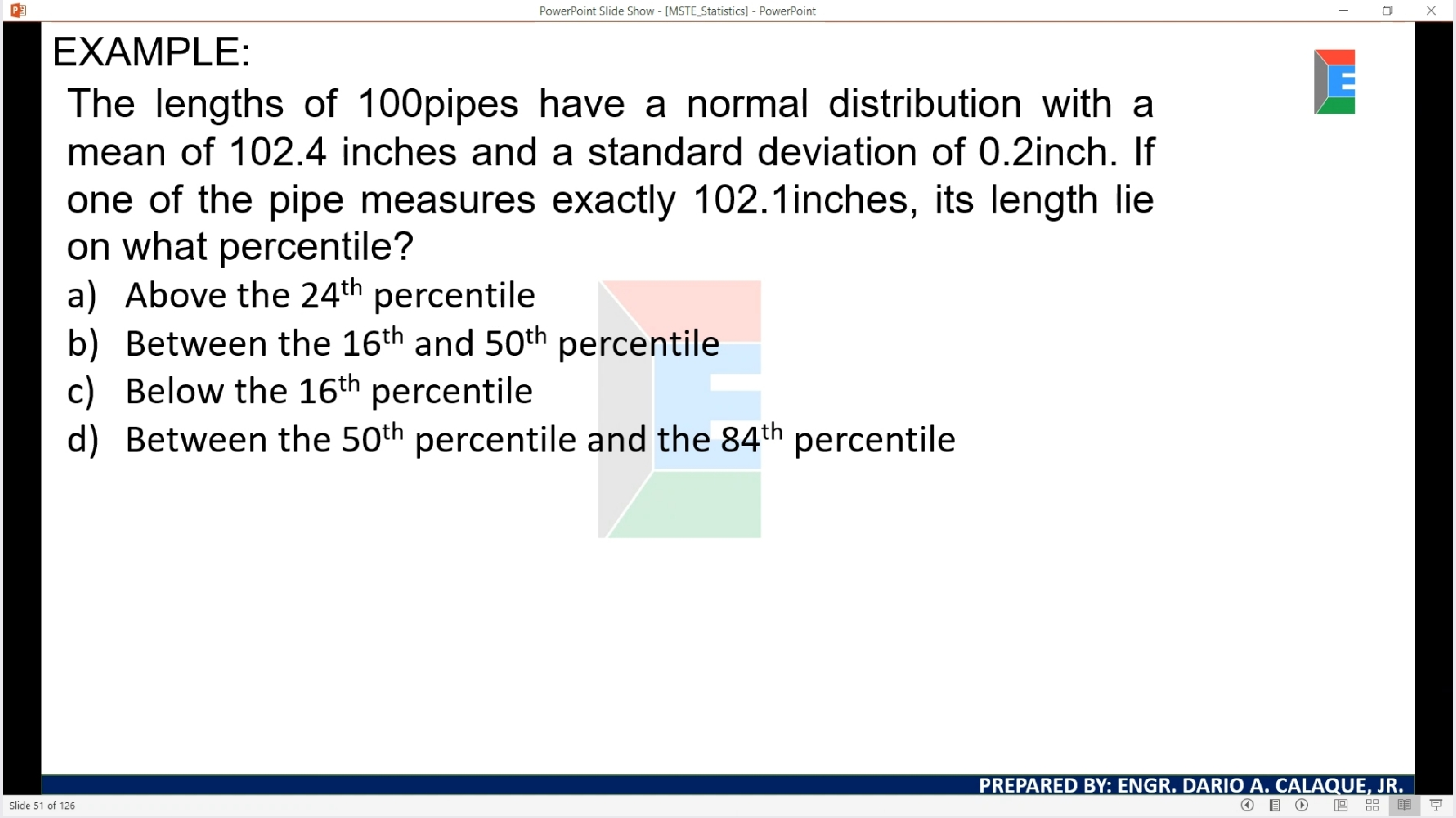
EXAMPLE:

On a standardized test, the distribution of scores is normal. The mean of the scores is 75 and the standard deviation is 5.8. If a student scored 83, the students score ranks in what percentile?

a) Between 75th percentile and the 84th percentile
b) Above the 75th percentile
c) Below the 75th percentile
d) Between 84th percentile and the 97th percentile

ANSWER:

Between 84th percentile and the 97th percentile


PowerPoint Slide Show - [MSTE_Statistics] - PowerPoint

EXAMPLE:

The lengths of 100pipes have a normal distribution with a mean of 102.4 inches and a standard deviation of 0.2inch. If one of the pipe measures exactly 102.1inches, its length lie on what percentile?

a) Above the 24th percentile
b) Between the 16th and 50th percentile
c) Below the 16th percentile
d) Between the 50th percentile and the 84th percentile

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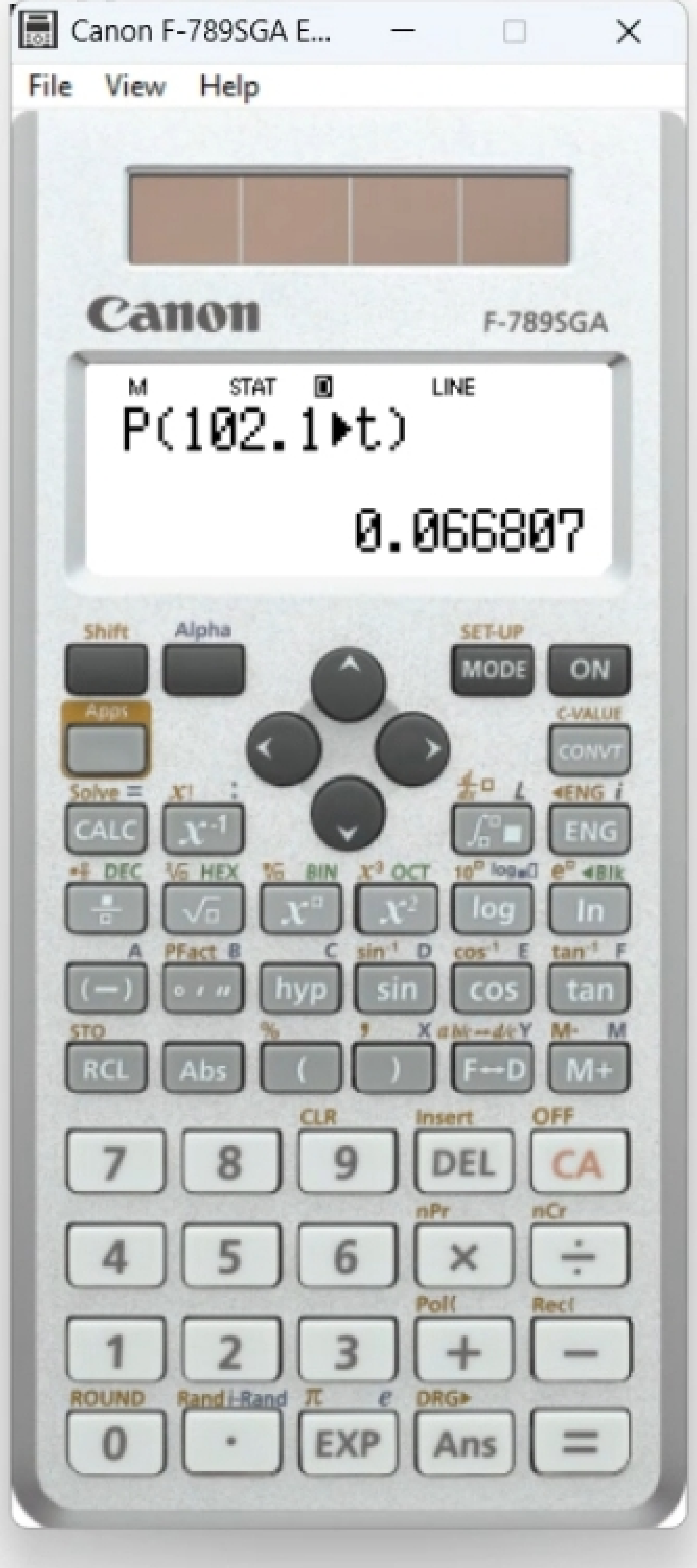
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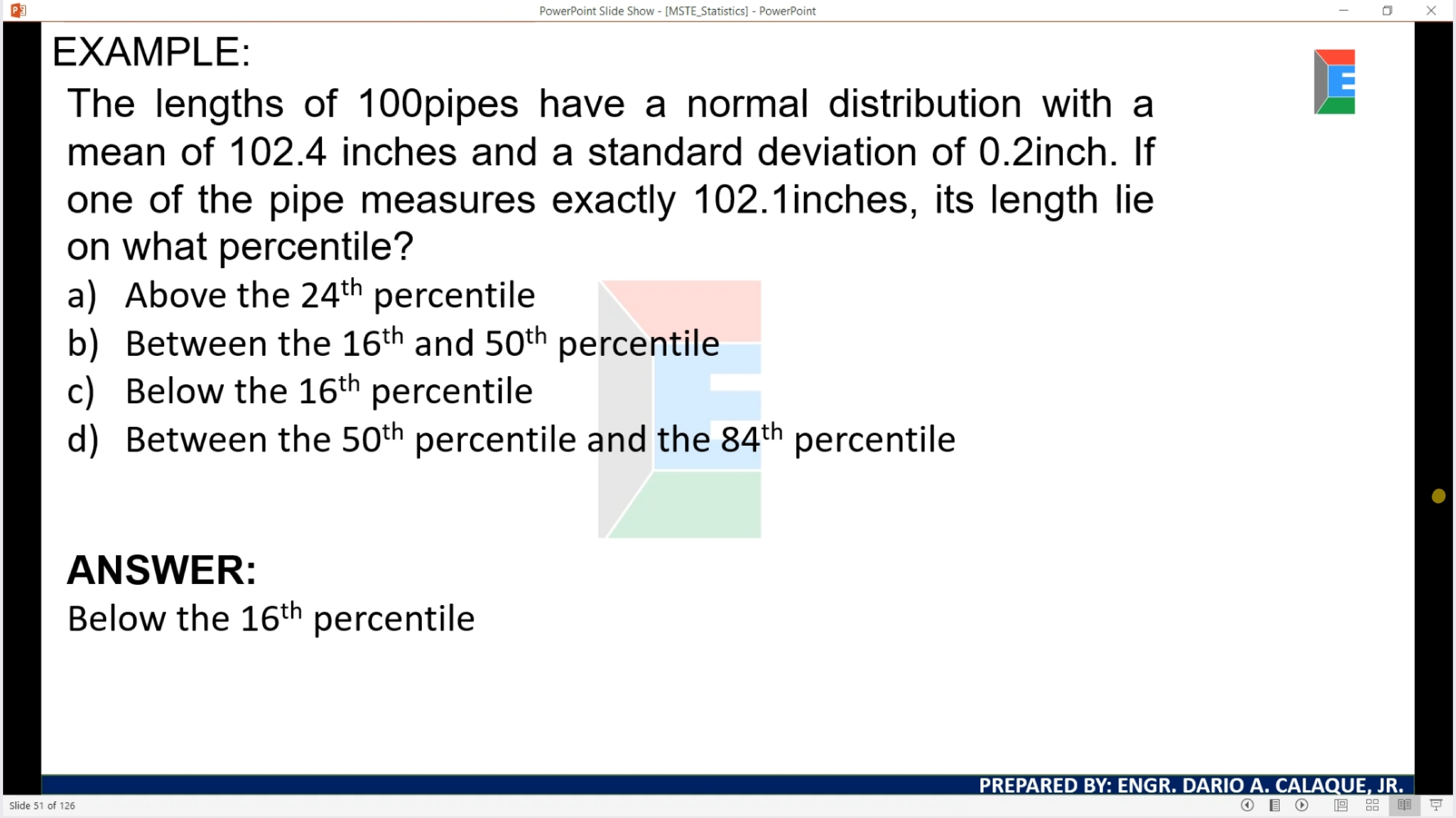
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ANSWER:

Below the 16th percentile